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ADDRESS BY THE PRESIDENT, JOHN. B. ROBERTS, A. M., M. D.

SOME DEFECTS IN ANATOMICAL TEACHING IN THE MEDICAL SCHOOLS OF THE UNITED STATES.

It has been truly said that anatomy and physiology are the foundation upon which the whole structure of medical education is built, and that consequently these sciences must be taught with exhaustive thoroughness and made the permanent intellectual property of the student.

The best medical schools in this country, with their four years' graded course requisite for the medical degree, have now attained an excellence probably not inferior to any similar educational institutions in the world. There still exist here, however, numerous useless and low-grade medical schools, destined to be soon destroyed by the rapidly increasing number of State medical examining boards. In some of the former class of schools, and in nearly all of other grades, anatomical teaching

has not reached the standard which the essential character of the subject demands. A consideration of the causes of this defective instruction and a search for efficient remedies seem appropriate. It is my hope that you who are present will discuss the statements of this address freely and fully, so that each of us may thereby find suggestions of value in elevating and improving the work done in our own schools and States.

It is a notorious fact that few of our students have any knowledge of biology when they begin the study of human anatomy. I know of but three schools in the United States (Johns Hopkins University, University of Michigan, and Hahnemann Medical College of Philadelphia) where a preliminary examination in elementary biology is required. Although an entrance examination in physics is enforced by many medical schools, there are others which admit without any such requirement. In those which submit students to this preliminary test, the examination is probably confined to very elementary questions. Several of our best schools still allow young men to begin the medical curriculum without any previous study of Latin. It is a little embarrassing to know that students entering homeopathic colleges are required by the American Institute of Homeopathy to possess a broader general education than is demanded of our students by the American Medical Association, the Association of American Medical Colleges, or our best medical schools. The preliminary educational requirements of the Hahnemann Medical College of Philadelphia include botany, chemistry, biology, physics, and Latin. Certainly not more than one or two schools include all of these topics in the entrance examination. It is not difficult to appreciate the confused ideas of human anatomy obtained by a first-year pupil, who knows little physics, less biology, and no Latin. What wonder that he fails to remember the names of the bones and muscles; and is filled with consternation when asked to mention an instance in the human body of a lever of the third class. He has no conception of the meaning of the descriptive Latin names of anatomical structures; wonders what is meant by "lever" and other mechanical terms; and is at a loss to know the significance of the terms "dorsal," "ventral," and "thoracic," and iter a tertio ad quartum ventriculum. Did not I, as a student, sit next to a man who was unable to understand the function of certain laryngeal structures because the professor attributed to them a mysterious use called "phonation?" Yet, under our present system such students listen to lectures on osteology, syndesmology, and myology and are expected to learn practical anatomy by dissecting the human body. To call such indecent butchery dissection is a farcical misnomer, as every demonstrator of anatomy knows. It would be much better to let these ill-trained hands learn the difference between muscle and fascia, nerve and vessel—which is about all such bungling teaches them—upon the dead bodies of the lower animals, and postpone dissection of human cadavers until the second or third year of the course.

Ebers has told in fiction of the Egyptian physician who, in the fourteenth century before Christ, ran the risk of condemnation by his heathen gods in order to obtain a human heart for studious dissection. You may remember his chagrin at finding his dearly bought prize so like that of the brutes he had often slaughtered in his quest for knowledge. Let the student of to-day begin his anatomical studies on the body of a dead cat and he will learn much that will enable him to prosecute investigations in human anatomy with the ease of one to whom its fundamental principles are already known.

One of the most detrimental results of the acceptance of medical students without preliminary education is that they have had no educational training in using their eyes and hands. An hour's stay in any dissecting room will prove this point. Here is a man holding his forceps as if they were fire tongs, there one making a fruitless attempt to put an edge on his scalpel.

Few students can describe what they see, and still fewer can make the crudest diagram of their findings. In scientifically conducted anatomical laboratories pupils should be required to describe orally or in writing what they uncover and

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should make drawings of the more important features. This method is adopted in nonmedical schools and in the study of histology and pathology in some medical institutions. It is undoubtedly the true method of educating the mind, which is not a receptacle to be simply filled with statements thrown into it from the lips of teachers. That which enters by the ears may lead to culture; but Nasmyth, the Scotch engineer, spoke truly when he wrote "the eyes and the fingers—the bare fingers—are the two principal inlets to sound practical instruction." Who doubts that the anatomical discoveries of Ruysch in the early part of eighteenth century were due to his possessing "the hands of a fairy and the eye of a lynx?" A recent writer on education avers that only in Germany and such countries as neglect to educate the young by means of manual training do we find men of learning who can scarcely sharpen a pencil without cutting their fingers. My experience in post-graduate teaching convinces me that for this reason good operative surgery is impossible for some very intelligent physicians.

Manual training is valuable moreover, because as Felix Adler has said, hand culture brings brain culture. We need not only the worth and beauty of the object made, but also the psychological result brought by the effort for the utilitarian end. Physicians know that Seguin actually created intelligence in idiotic brains by manual training, and that mental discipline must not be too much subordinated to mechanical accuracy. The medical growth of not a few capable minds has been dwarfed by modern instruments of clinical precision. The time has certainly come when the medical schools of the United States should insist upon a preliminary examination in elementary biology. As soon as this requirement can be extended to include a certain amount of laboratory work in biology, students will have sufficient deftness and manual dexterity, added to their preliminary knowledge of natural history, to fit them for intelligently studying descriptive and practical human anatomy. As you probably know, the British five years' medical course is reduced to four years in a medical school, if the registered student has previously graduated in arts or sciences at a recognized university requiring a year in physics, chemistry, and biology. If no such general education has been obtained these subjects are studied during the early part of the professional curriculum, which is then of necessity five years in length. In France the preliminary education of one who aspires to become "Docteur en Medicine" must show evidence of having had instruction in natural history as well as in all topics of general education. Germany and Italy also require a preliminary knowledge of natural history, as probably do all the European nations except Belgium. In Brazil, and I think in the other Latin-American countries, a biological requirement is a necessary part of the preliminary education of those who purpose beginning medical studies. A young man desirous of entering a medical school had much better wait a year, and devote that time to biology, chemistry, physics, and Latin than to attempt to begin professional study without an elementary acquaintance with these subjects. The University Extension courses will, in many sections of the country, give him the needed opportunity. If no such courses are accessible, a few books, even without a teacher, will answer the purpose.

If it be true that much unsuccessful anatomical teaching is due to the poor quality of the recipients, it is none the less demonstrable that a more extended influence for evil is exerted by the inferior mental qualifications of teachers and the unscientific methods of teaching permitted in some schools. This is, to a certain extent, the result of a custom that permits a professor, once appointed, to hold his position without forcible criticism until he dies or resigns, and prevents the faculty as a body influencing or regulating the manner or mode of instruction. The occupant of a professorial chair is practically an autocrat by courtesy.

Puschmann says that in the eighteenth century anatomical demonstrations on dissected bodies were frequent in many European universities, but that "in other places the neglect of anatomical demonstration was caused not so much by a

scarcity of bodies as by the idleness and ignorance of the professors." Such a statement, it is to be feared, is not altogether inapplicable to the anatomical instruction now given in some quarters of the United States. Some men of great learning can not teach. The faculty of imparting knowledge is distinct from the faculty of acquiring knowledge. To teach is not simply to tell, but is to make the fact stated so interesting and so clear that it assumes a living importance and is eagerly sought and intelligently retained by the hearer as a part of himself. A teacher must draw bold, clear outlines, omitting details, and repeating essentials until his pupils have a mental framework, upon which they themselves may erect more elaborate structures at a future time.

He who has not the power to select the essentials and lead the scholar to reason and observe is destitute of the teaching instinct. Then his lectures become mere recitations as wearisome to himself as to his involuntary hearers. The true teacher furnishes his pupil with compass and chart; no more. The latter must select his route and reach his harbor by the exercise of those intellectual powers which have been given him. It is experience and not memory that has been fitly called the mother of ideas.

Few teachers of to-day read their lectures on anatomy; but in some cases the lecture is still as lifeless as if read from manuscript or text-book, and destitute of either demonstration or true teaching. Didactic teaching can not be entirely relinquished, but it has little place in anatomy. Demonstration by specimen, dissected cadaver, blackboard diagram, and living model must be the chief reliance of the professor of anatomy who desires to hold the attention of his class and make anatomy what it is, one of the most interesting branches in the medical curriculum. Not many students will be absent from the lecture hour devoted to anatomy if they know that the statements read in their text-books are to be verified by electrical stimulation of the muscles on the nude model; that they are to see with their eyes and feel with their hands the difference between artery, vein, and nerve; that the teacher will create in colored crayon on the blackboard the diagram illustrating the relations of bone, muscle, and viscus; that the dissected cadaver will be studied in the standing posture; that the muscles of expression will be illustrated by photographs and etchings of public characters; that surface anatomy will become interesting because studied on reproductions of the famous works of ancient Greek art.

Muscular actions can only be taught effectively by voluntary use of the muscles of nude models, or by their involuntary contraction induced by the electrical current. Bones and other specimens in the hands of the instructors are of little value to the student seated 20 feet away. This distance effectually prohibits the latter from seeing the fissures, grooves, and foramina so learnedly mentioned by the teacher, who is perhaps simply reading for his own enlightenment the lettering printed on the bone. Even gigantic models in the hands of the teacher are less advantageous than duplicate specimens in the hands of the students during the time of instruction. Some teachers fail to appreciate that an elaborate picture, though valuable for reference by one who has known the anatomical region, is of little service to a student. The crudest diagram, made before the latter's eyes, conveys the idea and fixes it in his brain. A piece of chalk and a blackboard are imperatively demanded whenever and wherever anatomy is to be taught. Yet I recall the dissecting room of a well-known medical school which for years had no blackboard, no chalk, and no skeleton within its walls.

Occupants of chairs of anatomy not infrequently look upon their positions as temporary, and long for the occasion when they may be transferred to a department in which they feel more interest. Who does not know professors of anatomy that promptly became professors of surgery or obstetrics when the opportunity arose? One can as little expect such temporary anatomical chairs to be filled with enthusiastic and successful teachers, as to find proper teaching of applied medical and surgical anatomy at the hands of physicians whose daily work is literature or life

insurance. Again, it is not reasonable to expect those whose early education has been defective to be able to teach the mutual relations of anatomy to biology, mechanics, and psychology. The student needs a wide preliminary education in general knowledge; but the teacher of anatomy is helpless without it.

No criticism is too severe for the system that places first and second course medical students in one class room to hear the same didactic lectures on anatomy. Such a parody of instruction is probably unknown except in medical schools. To compel half of the class to hear what they can not possibly understand, to force the other half to listen to much that they have already learned, is recognized as idiocy by every one, except the professional phonograph that each year repeats at a given hour the words which successive classes have received as instruction. Teaching that is not graded so as to lead step by step to higher knowledge is unworthy the name. It is impossible to compute the lost hours, undeveloped intellects, and disasters in medical practice due to this almost distinctively American folly. This undesirable method of teaching has been retained in the department of anatomy longer than in some other departments, because the important new facts to be taught in anatomy have been less numerous and conspicuous; therefore the whole subject can be pretty completely discussed in one session of lectures.

No method of instruction fulfills its mission if it does not develop the habit of independent investigation and work. Pupils need to be taught the manner of instituting and following out original inquiries and the use of the literature of a subject. Few colleges attempt to thus arouse the powers of observation and to sharpen the senses; for the prizes offered in some schools for a record of anomalies found in the dissecting room scarcely deserve consideration in this connection. Opportunities for original research in human anatomy are now given, and such work is encouraged at the Harvard University Medical School, The College of Physicians and Surgeons of New York, and in the medical department of Clark University, at Worcester, Mass. The last institution, however, confers no degrees in medicine and does not partake of the character of a school for undergraduates. Didactic instruction at the hands of teachers who never contribute a single new fact or thought to anatomical or medical literature is not calculated to encourage a spirit of scientific inquiry in students. The demonstrated usefulness to the scientific world of a teacher's original labor is a powerful stimulant to investigation and scientific rivalry among his pupils. The need of such opportunity and example is much felt in our schools.

In certain things we need to return to methods employed in the middle ages, but later overlooked or forgotten. In the beginning of the fifteenth century naked men were used to demonstrate anatomical facts, and it is possible that outline diagrams of the deeper structure were made on the bare skin. Experience with students has abundantly shown me that such "anatomical clinics" meet with great favor. To group in one lecture several nude models representing the effects of disease on anatomical landmarks is most valuable and essential in teaching and sustaining interest in clinical anatomy. "Clinical conferences," in which before his fellows the advanced student points out and demonstrates anatomical relations upon the living subject, develop a habit of thorough investigation of medical and surgical cases. Its subsequent value in diagnosis is easily appreciated.

This form of anatomical teaching is manifestly impossible to an instructor who has no practical knowledge of disease conditions. The necessity for comparative anatomy, morphology, embryology, and anthropology in a perfectly arranged anatomical curriculum may require a portion of the instruction to be given by a biologist, pure and simple; as long, however, as a medical school is to train medical practitioners the demand for a physician or surgeon to teach medical, surgical, and artistic anatomy will be imperative. The school that provides an enthusiastic biologist for the one purpose and a practicing doctor for the other will best fill the hours devoted to anatomy in the college course.

The lengthening of the medical curriculum in all schools to compel attendance on four college courses would give time for laboratory work in embryology and com-

parative anatomy. Graduation should then be deferred until the age of 22 years, as is now done in one school (Woman's Medical College of Pennsylvania).

The museums found in medical colleges lose much of their teaching value because the students have limited access to the specimens. Bones and dissected preparations, both wet and dry, of normal anatomy should be put in the student's hands for comparison with his own dissections and the text-book illustrations. In most cases the teacher alone handles the museum specimens. Wet preparations demonstrating normal regional anatomy are almost unknown in our college collections.

The work done by students in the anatomical rooms would be of a much higher grade if each member of the class was required to draw, even in crude outlines, the structures uncovered by his dissections, and under the guidance of an instructor to demonstrate his findings to his fellows. The necessity of preserving cadavers in this country by vascular injection with zinc chloride and similar decolorizing agents militates to a certain degree against fine work in our dissecting rooms. The adoption of the principle of cold storage by some schools (Bellevue Hospital Medical College, Chicago Medical College, medical department of Western Reserve University) shows a way out of the dilemma.

Examinations in anatomy, which might be public, should be conducted at various periods of the course. Those in the early part ought to be restricted to osteology and similar elementary topics; but the later and more difficult examinations in regional, medical, surgical, and artistic anatomy should be so conducted as to require the use of the earlier knowledge, and include demonstrations of surface anatomy and of dissections. A substitution of English terms for the Latin nomenclature, still largely retained in anatomy, would aid the average medical pupil to understand anatomical mechanics and remember the facts which he has presented to him. Much was gained in European schools when the mediæval practice of teaching medicine in debased Latin was relinquished. The professor who had to use the vernacular was compelled to be accurate in statement and clear in expression, and could no longer hide his ignorance in high-sounding Latin sentences imperfectly understood by his class.

The true solution of the educational problem in medicine is the discontinuance of the isolation existing between medical schools and schools whose object is general education and culture. Every medical school should be an integral part of a college or university, and should not be managed by men separated from the wholesome educational atmosphere which surrounds institutions devoted to learning in its broadest sense. The perpetuation and organization of isolated medical schools has been the cause of manifold defects in medical teaching, and has ended in making medical pedagogics an undeveloped science. The educational and educative friendships, even the hostilities, engendered by a combination of medical and academical schools would bring about better preliminary qualifications in medical students and more advanced methods of teaching in professors. It is the school and the man in the corner who never comes in contact with his superiors, that fails to improve his methods of work. The valuable "courses preparatory to medicine" now found in several universities, would become more numerous; and more youths, looking forward to a medical career, would begin their studies in such courses, if the university and the medical college were everywhere combined. Thus the study of medicine would be a gradual development of the mind and not a mere attempt to crowd technical facts in the memory; a process in violation of the first principles of education, and one which makes many medical journeymen, but few medical masters.

Universities, academies, and all literary schools would be benefited by the association with medical colleges, as it would lead to even greater modification of the former rigid classical course by the development of the departments of natural science and languages. This change would meet with the approval of many thinkers, among others the Emperor of Germany, who, you remember, has in recent years shown the value of youthful energy by insisting upon the necessity of modifying the strict and unyielding classical curriculum so long enforced by the German universities.

PAPERS READ BEFORE THE SECTION.

THE DISSECTING ROOM.

By E. W. HOLMES, M. D., of Philadelphia, Pa.

I had anticipated the pleasure of reviewing the various problems in the practical management of the anatomical room, in order to derive advantage from the experienced discussion and criticism of those present, but the exigencies of time and space enjoin the omission of many.

I would not have ventured upon the selection of this topic in this presence were it not for the evident neglect of this important branch of medical study of late years. That anatomical study was the basis of all medical knowledge, that a dissecting room, a supply of bodies, and a corps of teachers were absolutely necessary, have always been axioms. But more than that, what has been done in the majority of the schools. Look at the immense improvements in other branches. Twenty-five years ago well-equipped physiological and chemical and physical laboratories were uncommon; pathological museums were almost unknown, except in name, and practical hygiene and bacteriology were not in existence. To-day the opportunities for research in any one of these would busy a lifetime, but in anatomy we stand only on the basis of the needs of a quarter of a century ago. Formerly, anatomy claimed a good one-seventh of the required studies; to-day, it but weakly elbows a space with twenty ologies and specialties which have been elevated by their more enthusiastic advocates.

We often estimate the speed of our train by the rapidity with which we rush by stationary objects; and conversely, as practical anatomists, we can see how we have stood still by the rapid passing of the collateral branches which have asserted their importance and taken to themselves the time and attention which our branch needs.

One of the main reasons has been the teaching methods in vogue—the more instruction by lecturing, the fewer instructors required—which has practically resulted in the added emphasis of the lecture system and the minimizing of the personal supervision in dissection. The method of bedside instruction in medicine and surgery does not obtain, as it should, in the dissecting room of to-day. This is peculiarly unfortunate. Lecturing methods are especially ill fitted for the impressing of our facts. Really, the exigencies of practice of medicine and surgery demand the application of these facts through the eye and hand and not by the ear, and yet the best lecturer can not exhibit his dissection to more than 50 students seated around him, and when you remember that in the larger schools often there are 700, you appreciate how really ineffective is the method. Not that I deprecate in the least the value of the experience of the accomplished anatomist who directs in his lecture the novice in his studies; but a lecture course can not teach, it can only point out the way, while the real learning must be be done by the student himself in his room and at the cadaver.

The emphasis, however, is ever laid upon the attendance upon the hours of the lecture, and the compulsion is upon the examination upon those lectures. There is hardly a medical school that absolutely insists upon the student being present at fixed hours in the dissecting room. Dissecting, of course, is obligatory, and it sets apart certain periods for dissecting when the student can come if he wishes to, like the ancient almanacs that stretch across the whole month's page, "Look out for rain about this time." Students are divided into small sections for bedside instruction in clinical medicine and surgery, but "nary a bit" for dissecting work. Who ever heard of modernized teaching facilities for the dissecting room? There is nothing beyond the corpse, the cadaver, and the corps of teachers, and a skeleton

or two, and the few nude pictures of three decades back. The museum is for the illustration of the lectures, and is separated far and wide from the anatomical room. Then the anatomical room itself—it is a dirty place, you know. If there is any extra paint or adornment, it does not go there. It is the most unattractive room in the school, and the most inaccessible.

I need not apologize for wishing that something could be done to vivify the interest in our noble science. There is no branch of so much practical usefulness upon which there is such probable ignorance in the profession as this. Further, when you think that chemistry, physiology, etc., may be conducted and studied at a distance, but human anatomy only in the medical school, the need of stimulating the student to use all his efforts to avail himself of opportunities, which assuredly for the majority will never come again, is most imperative. The remedy is not far to seek. The same methods so successful elsewhere have not been, but should be, applied to the study of anatomy.

The classes should be divided into small sections for the "bedside study" of the cadaver. Skilled instructors who make this a specialty should be continually at the elbow to encourage, direct, and drill. A demonstrator of anatomy should not be a practitioner, but a specialist spending his whole time in the rooms and saturated with the anatomical atmosphere. No one can fulfill the office of a teacher who is not filled full of his subject. The hours of the sections for histology or hygiene are fixed and certain; and so should it be here, and not left to an elastic sweet will, which too often does not will to go at all.

The anatomical room should properly be in a building by itself, of but one story, easy of access, so that it may be the haunt of the pupil when not otherwise engaged, or when an empty one-fourth hour should tempt to the speedy elucidation of some single point. There should be ample facilities for instruction—strike while the iron is hot, is the right principle. I will guarantee that a specimen, well worked out, placed in the hands of a student while engaged upon a given part, is ten times the worth to him that it is when held up at the distance of 20 feet in the midst of a formal lecture, or when kept high upon the sacred shelf of the medical museum. The museum in a medical school is usually of comparatively little use. Each dissecting room should have its own collection of moist and dry specimens in jars or in cases of ready access when the student may be most interested, and therefore most needs it. This dissection is a two-headed Janus (for we must dissect in order to know), yet in order to dissect intelligently we must have some foreknowledge, and this paradox is best solved by the study of the moist and dry preparations which the student should be encouraged to examine, both before and after, as well as during the procedure of dissection.

Then, the instruction should be direct and personal. It is here, as in everyday life—the greatest philanthropist is not he who helps many wholesale or insists upon the unfortunate doing his way, but rather the one who kindly helps when help is needed, and without protrusion of self gently lifts the fellow out of the rut of wrongdoing. "A friend in need is a friend indeed," implies that the proper aid is given just at the time required, not before. Demonstrations therefore should be personal and upon the cadaver, not a mere recital of facts. Class demonstrations are useful particularly for a rapid résumé to the more advanced student, but the speechmaking should be subsidiary to the demonstration of structure. An ideal method perhaps would be to encourage each student to carefully prepare and preserve his own dissections, as thereby would be acquired a stimulus to more careful work, and then at the time of demonstration each would have in his hands a dissection upon which to follow the explanation of the teacher.

I have spoken of the emphasis laid upon the examination after the lecture course. This is only a means to an end, but to the majority it is the *ultima Thule*. It would be far better to exact an examination upon each dissection and at the end of the course a finality upon the cadaver,

I have already disclaimed any intention of detracting one iota from the value of lectures, but really how opportune if the phonograph could be utilized for this purpose. Let the most able and scientific of this society write out a series of lectures which could be spoken into the instrument by the most eloquent member. Then a tyro could turn the crank and deliver to a delighted audience the most perfect of courses and these could be multiplied indefinitely so that each medical school could be supplied on demand, while thereby could be secured that uniformity of nomenclature which has harassed the minds and hearts of our members for a considerable season.

There is one other point I wish to touch upon. (1) The absence of systematic records of anomalies and pathological lesions which would be of extreme value if properly noted, and the waste of magnificent material yearly in all of the schools which could readily be utilized for scientific purposes. Think you a dissecting room is only to study anatomy? There is a wealth of pathology, a richness of surgical knowledge, a treasure of medical story, a mine of anomalous relations, all gone, burned, or buried. Like the early miner of the West, in our haste and with our careless or crude methods, we overlook the very gold we fain would grasp, and some more careful worker will enrich himself and his race from the waste which we throw away. I have endeavored to point out some of the more glaring defects in the anatomical room which stand in the way of its improvement.

(1) It is subordinated to the lecture method which, rightly, should be subordinate to it.

(2) It is too often repulsive and inaccessible.

(3) It is not managed with precision that find in other departments.

(4) The teaching facilities are rarely what they should be, and should be supplemented by an extensive museum, ready of access under proper regulations to the student, who should be allowed to handle the specimens himself.

(5) The teaching should be personal and demonstrative rather than didactic.

(6) The test should be one of practical knowledge of the cadaver, rather than of merely theoretical data.

(7) A proper record of all anomalies and pathological lesions found should be kept, and the invaluable specimens added to the teaching facilities of the various departments of the school.

THE HUMAN HAND.

By GEORGE WILLIAM WEAR, M. D., of Washington, D. C.

The human body is one of the most worthy objects of man's study. It is the noblest as well as the crowning work of creation. In it material organization is carried to the greatest perfection. There is no part of the human body which is more significant in its actions, which is more characteristic in its formation than the hand. One of the first points which obtrude themselves upon the student of anatomy is the absolute perfection of the human hand as regards its construction and the uses to which it is adapted. In no other combination of bones, muscles, and nerves, and in no other animal do we find a perfection which results in such superiority with regard to strength, variety, extent, and rapidity of motion; and this perfection undoubtedly resulting from the intimate relations which exist between the hand and the intellect, we are irresistibly to ask with Sir Charles Bell: "Is it nothing to have our minds awakened to the perception of the numerous proofs of design which present themselves in the study of the hand, to be brought to the conviction that everything in its structure is orderly and systematic, and that the most perfect mechanism, the most minute and curious apparatus, and sensibilities the most delicate and appropriate, are all combined in operation that we may move the hand?"

As Galen remarks: "Let us then scrutinize this member of the body and inquire, not simply whether it be in itself useful for all the purposes of life, and adapted to an animal imbued with the highest intelligence, but whether its entire structure be not such that it could not be improved by any conceivable alteration." The wants of man are greater and more varied than those of any other animal; therefore, he has had given to him what he alone of animals possesses, and what to him alone is necessary, viz, the hand. The genus homo, or man, takes rank in the classification of mammals as a distinct order, Bimana, in consequence of man being the only animal possessing two hands. At first sight, it might be considered that four-handed animals, the monkeys, apes, and their allies which are placed by zoölogists in the order Quadrumana, were superior to those which possess only two hands, but this is far from being the case. None of these four hands are adapted to the variety of actions which the human hand is capable of performing, and they are all to some degree, required for support and locomotion; so that while in the higher forms of the quadrumana the extremities present an approximation in structure to those of man, in the lower they gradually tend to resemble the ordinary quadrupedal type. "That," says Cuvier, "which constitutes the hand, properly so called, is the faculty of opposing the thumb to the other fingers, so as to seize upon the most minute objects, a faculty which is carried to its highest degree of perfection in man, in whom the whole anterior extremity is free and can be employed in prehension."

The peculiar prehensile power of the human hand is chiefly dependent upon the length, power, and mobility of the thumb, which can be brought into exact opposition to the extremities of all the fingers whether separately or grouped together. Some animals are bold and fierce, others are timid and gentle, some are gregarious and coöperate for their mutual sustenance and defense; others are solitary and avoid the society of their fellows; but all have a form or body accommodated to their natural dispositions and habits. Thus, the lion has powerful fangs and claws; the hare has swiftness of foot, but is otherwise defenseless. And the fitness of this arrangement is obvious; for those weapons which the lion is furnished with are as appropriate to his nature as they would be inappropriate to the timid hare, whose safety, depending entirely on flight, requires that swiftness of foot for which she is so remarkable. But to man, the only animal that partakes of divine intelligence, the Creator has given, in lieu of every other natural weapon or organ of defense, that instrument, the hand, an instrument applicable to every art and occasion as well of peace as of war. Man, therefore, wants not a hoof or a horn or any other natural weapon, inasmuch as he is able with his hand to grasp a much more effective weapon, the sword or the spear; for a sword or a javelin are better arms than the nails, and cut and pierce more readily. Besides which, natural weapons can be employed only in close conflict, while some of the weapons employed by man, such as javelins or arrows, are even more effective at a distance. He is enabled more easily by this instrument to clothe himself with armor of various kinds or to intrench himself within camps or fenced cities, whereas were his hands encumbered with any natural armor, he would be unable to employ them for the fabrication of those instruments and means which give him such a decided advantage over all the other animals of creation.

With the hand we weave the garments which protect us from heat and cold in summer and winter, and construct the nets and snares with which we subjugate the brute creation. With the hand we fashion all the implements of art and science, and, lastly, by means of the hand man bequeaths to posterity in writing the intellectual treasures of his own divine imagination; and hence we who are living at this day are enabled to hold converse with Plato and Aristotle and all the venerable sages of antiquity. Thus the hand keeps constantly before us the proofs of the special adaptions of the various parts of the body to the uses to which the parts are to be put. "In man," says Prof. Owen, "while one pair of limbs is expressly organized for locomotion and standing in the erect position, the other pair is left free to

execute the manifold behests of his rational and inventive will, and exquisitely organized for delicate touch and prehension, emphatically called manipulation." The hand is essentially the organ of the mind, the medium of its expression, and the instrument whereby its promptings are carried into execution. "We first see the hand," says Sir Charles Bell, "ministering to man's necessities and sustaining the life of the individual; in a second stage of his progress we see it adapted to the wants of society, when man becomes a laborer and an artificer; in a state still more advanced, science is brought in aid of mechanical ingenuity, and the elements which seem adverse to the progress of society become the means conducing to it." The seas, which at first set limits to nations and grouped mankind into families, are now the means by which they are associated.

Before entering further into the description of the hand, it is necessary to say a few words on the upper extremity generally, of which the hand may be regarded as the essential part. The general plan of the osseous framework of the upper and lower limbs is very similar. The humerus, or arm bone, corresponds to the femur, or thigh bone; the lower end of the humerus is connected with the two bones of the forearm, the radius and the ulna, which correspond with the two bones of the leg, the tibia and fibula. Then come the carpal bones, the metacarpal bones, and the phalanges, just as we have tarsal bones, metatarsal bones, and phalanges in the foot. It is not necessary to enter into any anatomical details regarding the individual carpal bones. Collectively they are so arranged that the carpus presents a dorsal convex surface, upon which the tendons of the extensor muscles of the fingers play, and a palmar concave surface, on which the tendons of the flexor muscles lie. The several bones are joined to one another, each bone being united to three or more others by a large extent of surface, and are girded together by strong ligamentous bands. The wrist is thus as strong as if had been constructed of one solid piece of bone, while the slight gliding movements which occur between the several bones give it an elasticity which serves to break the shocks that result from falls upon the hand. The uppermost surface of the first row of carpal bones is convex, and this convex surface is received into a wide cup, or socket, formed by the lower articular surface of the radius and by a ligament passing from that bone to the ulna. The metacarpal bones and the phalanges require no special description. Like the great toe, the thumb has only two phalanges, while each of the other digits has three. The scapula, or shoulder blade, with which the principal arm bone articulates, is itself movable to a considerable extent on the surface of the ribs, on which it rests. Again, the socket in which the nearly spherical head of the humerus, or arm bone, lies is very shallow, not unlike the cup in the well-known toy cup and ball, and the arrangements of the shoulder joint generally are such as to permit so great a variety and so extensive a range of movements that we are able to apply the hand to every part of the body. This freedom of motion is due in a great degree to the clavicles, or collar bones, which, by steadying the shoulder blades and keeping the shoulders apart, afford a fixed point for the various muscles which we employ in raising the arms, in folding them over the chest in the act of hugging, or in the attitude of prayer. The movement of the next junction of bones, the elbow joint, are very different from that at the shoulder. The latter is termed, from its construction, a ball-and-socket joint, and admits of motion in all directions, within definite limits, while the former is a hinge joint, and merely admits of bending and straightening, or, in other words, of motion in one plane.

A full consideration of the muscles of the hand would take too much time. We may demonstrate upward of fifty muscles of the arm and hand, all of which must consent to the simplest action. Nothing appears to us more simple than raising the arm or pointing with the finger; yet, in that simple act, not only are innumerable muscles put into activity, and as many thrown out of action, but both the relaxing and the contracting muscles are controlled or adjusted with the utmost precision, though in opposite states, and under one act of volition. To the anatomical student, the mode of demonstrating the muscles of the human hand and arm becomes

the test of his master's perfection as a teacher. When they are taken successively, just as they present themselves in the arm, nothing can be more uninteresting, tedious, and difficult to attend to than such a demonstration; but when they are taught with lucid arrangement, according to the motions performed by the distinct groups of muscles, it is positively agreeable to find how much interest may be given to the subject.

Just here we will consider a class of movements of the forearm and hand, to which there is nothing analogous (at least to any material extent) in the leg. The movements in question are called pronation and supination. In pronation (derived from *pronus*, with the face downward) we turn the palm of the hand downward, as in picking up any substance from the table; in supination (derived from *supinus*, with the face upward) we turn the palm upward, as for the purpose of receiving anything that may be placed in it. These movements of pronation and supination are so important to the usefulness of the hand that it is necessary to notice the three muscles by which they are chiefly produced. One of the three muscles passes from a projecting process on the inner side of the humerus, at its lower end, to the outer edge of the middle of the radius. Its contraction causes the radius to roll over, or in front of, the ulna; it thus pronates the hand, and is called a pronator muscle (*pronator radii teres*). Another muscle passes from a projecting process on the outer side of the humerus to the inner edge of the radius near its upper part. It runs, therefore, in an opposite direction to the former muscle, and produces an opposite effect, rolling the radius and the hand back into the position of supination; hence, it is called a supinator muscle. The third is a very powerful muscle, termed the biceps, which not only bends the elbow, but from the mode in which its tendon is inserted into the inner side of the radius, also rotates the radius so as to supinate the hand, and it gives great power to that movement. Mechanicians have observed that they have more power to supinate the hand than to pronate it. Supination can only be performed to its full extent by man, and even in man it is not the natural or habitual position; monkeys can partially effect the movement, and in most of the lower animals the part corresponding anatomically to the hand is constantly in a state of pronation.

The movements of which the hand itself, without reference to the arm, is capable, are very numerous, and in this respect differ considerably from the corresponding movements of the foot. Thus the fingers can be bent down upon the palms or they can be extended beyond the straight line; they can be separated from one another to a considerable extent, and they can be closed with considerable force. The wrist and hands are bent forward, or flexed, upon the forearm by three muscles which pass downward from the inner condyle of the humerus, and are termed the radial flexor, the ulna flexor, and the long palmar muscles. The first two of these muscles are inserted into the wrist bones on the radial and ulna sides, respectively, while the third expands into a fanlike fascia, or membrane, in the palm of the hand, and thus serves both to support the skin of the palm and to protect the nerves and vessels which lie below it. Beneath the palmar fascia lie two sets of flexor muscles of the fingers, and they present so beautiful a mechanical arrangement as to merit special notice. The superficial or perforated flexor muscle passes down the front of the forearm and divides into four tendons, which becomes apparent after removing the palmar fascia, and are inserted into the second phalanges of the fingers, each tendon splitting at its termination, to give passage to the similar tendons of the deep or perforating flexor muscle, which passes from the upper part of the ulna to be inserted into the last phalanx of each finger. These flexor muscles are antagonized by the common extensor muscle of the fingers, which, like the flexors, divides into four tendons, one for each finger. Besides these, there is a special extensor of the index finger, a series of muscles forming the ball of the thumb, which move that organ in almost every direction, and various small slips giving lateral and other movements to the fingers.

The hand contains two principal arteries, the radial and the ulnar. The ulnar proceeds in a curve from the wrist to the first finger where it joins a branch of the radial, forming what is known as the superficial palmar arch. Four digital arteries go from its convexity, which subdivide into collateral branches about two lines below the metacarpo-phalangeal articulations. These supply the palmar and lateral surfaces of the fingers, excepting the thumb and the outer side of the index, the branches coalescing at the tips of the fingers, whence branches arise to supply the pulp of the fingers with blood. The radial goes from the end of the forearm (radius) round the wrist, between the thumb and index finger, and back into the palm, where, joining the ulnar, it forms what is known as the deep palmar arch. Before, however, it does this, it gives off two arteries, one of which (the *superficialis volæ*) supplies the palm. whilst the other divides into two branches (the *arteriæ dorsales pollicis*) which run along either side of the thumb, one of which branches sends off an artery to the index finger. When the radial dips into the palm it gives off branches to the thumb and forefinger or index, and to the deep palm (where it joins the ulnar). The veins, which are generally very deep, accompany the arteries.

The most important subject for our consideration is that of the nervous system of the hand, of that complicated plexus of nerves which gives to the hand its direct and constantly apparent connection with the brain. Without the hand, principal seat as it is of the sense of touch, the other senses would be comparatively useless. The sense of touch is the only sense which is reciprocal. That is, though the senses of sight, hearing, taste, and smell, can only receive impressions without giving them, that of touch, both receives and gives; and it is this sense of touch, dependent as it is upon the nervous system, which is the most important of all, and which is found in its highest state of development where that nervous system is the most complete, namely, in the hand.

An accumulation of fat and fibrous tissue under the skin forms the "pulps" at the ends of the fingers. The slightly conical form and exquisite softness of the pulps adapts them well for the examination of the surfaces of bodies; and the sense of touch is more acute in them than in other parts of the hand. In connection with them it is interesting to observe that the last bone of each finger and of the thumb swells out at the end into a nodulated lump, which serves the purpose both of supporting the pulp and of giving breadth to the nail. The cuticle is the medium through which the external impression is conveyed to the nerves of touch. The extremities of the fingers exhibit all the provisions for the exercise of this sense. The nails give support to the fingers; they are made broad and shieldlike, in order to sustain the elastic cushion which forms their extremity. This cushion on the end of the finger is a very important part of the exterior apparatus, its fullness and elasticity adapting it admirably for touch. Fine as the sense of touch usually is in the hand, it becomes far more so when an unusual demand is made upon it in consequence of a deficiency or absence of other senses. The rapidity with which blind persons can read with their fingers is truly astonishing. Some are said to distinguish colors by the feel. It should rather be said that they are capable of recognizing the nice differences in certain substances by which colors are caused; for one can scarcely conceive it possible to distinguish by feeling the colors in a ray of light separated by a prism.

It was said of a lady who had been not only blind but deaf and dumb from infancy: "The sense of touch was, therefore, almost her only avenue for impressions from without, and it was surprising how much information was conveyed through it, and how quickly It enabled her to hold converse with her relatives, by the language of the fingers, almost as freely and as briskly as others did with the tongue. A few touches were sufficient to transmit a series of thoughts. After one shake of the hand of a stranger she would immediately recognize him on meeting him again."

Persons who have had much experience in the instruction of the deaf and dumb find that the hand, by means of writing and "dactylology," or the language of finger signs, is abundantly sufficient for all the intercourse to which a deaf-mute is equal;

and they are, therefore, disposed to discourage the teaching of articulation. The capacity, therefore, which the hand enjoys of ascertaining the distance, the size, the weight, the form, the hardness or softness, the roughness or smoothness of objects, results from its having a compound function, from the sensibility of the proper organ of touch, being combined with the consciousness of the motion of the arm, hand, and fingers. But it is the motion of the fingers that is especially necessary to the sense of touch. These bend or extend, or expand or move in every direction, like palpa, with the advantage of embracing the object, feeling it on all its surfaces, estimating its solidity or its resistance when grasped, moving round it, and gliding over its surfaces, so as to feel every asperity and be sensible of every slight vibration.

Why is man usually right-handed? Many attempts have been made to answer this question. Is the superiority of the right hand real and natural, that is, congenital, or is it merely acquired? All men are not right-handed; some are left-handed; and some are ambidextrous. In the tribe of Benjamin "there were seven hundred chosen men left-handed; every one could sling stones at an hair breadth and not miss." (Judges xx, 16.) When David was at Ziklag there came to him a company of men who "were armed with bows and could use both the right hand and the left in hurling stones and shooting arrows out of a bow." (1 Chronicles, xii, 2.) There is an universal consent among all nations to give the preference to the right hand over the left. This can not be a conventional agreement; it must have a natural source. For the convenience of life, and to make us prompt and dexterous, it is pretty evident that there ought to be no hesitation which hand should be used, or which foot should be put forward; nor is there, in fact, any such indecision. Is this readiness taught, or is it given to us by nature? It is suggested that if the right side were orginally the most powerful in man, we might expect to find it the same in other animals. It is affirmed that squirrels, monkeys, and parrots feed themselves with the left leg rather than with the right. But the parrot may be said to use the strongest foot where most strength is required; that is in grasping the perch and standing, not in feeding itself. It must be observed at the same time that there is a distinction in the whole right side of the body as well as in the arms, and that the left side is not only the weaker in regard to muscular strength but also in its vital or constitutional properties.

The development of the organs of action and motion is greatest upon the right side, as may at any time be ascertained by measurement or the testimony of the tailor or shoemaker. Certainly this superiority may be said to result from the more frequent exertion of this side; but the peculiarity extends to the constitution also; and disease attacks the left extremities more frequently than the right. In walking behind a person it is seldom that we see an equalized motion of the body; and if we look to the left foot, we shall find that the tread is not so firm upon it, that the toe is not so much turned out, and that a greater push is made with the right foot. The horseman puts the left foot in the stirrup and springs from the right. We think we may conclude that the adaptation of the form of everything in the conveniences of life to the right hand, as for example, the direction of the worm of the screw, or of the cutting end of the auger, or the shape of other tools or instruments, is not arbitrary, but is related to a natural endowment of the body. On the whole, the preference of the right hand is not the effect of habit, but is a natural provision, and is bestowed for a very obvious purpose; the preference is given to the right foot as well as to the right hand.

DISCUSSION.

Dr. Lamb said that the general opinion seems to be that the left side of the brain appears to be better supplied with blood as a consequence of the arrangement of the branching of the arch of the aorta. As a consequence of this greater development of the left side of the brain, we have the greater development and use of the right upper extremity. It may be well to notice in this connection the fact that in very

many cases there are eight costal cartilages connecting with the sternum on the right side, giving, therefore, a greater support to the right upper extremity.

Dr. Lamb has recently made a post-mortem examination of a woman who was left handed, and there were eight cartilages on that side connected with the sternum.

Dr. Reyburn stated that in all probability the larger supply of blood given to the right upper extremity will account for its greater development. The great difficulty in this matter is the want of text-books on anatomy written from the standpoint of studying human anatomy as the development from the human brain; but it will be done soon by someone, and the book will render his name immortal.

Dr. Baker remarked that the dextral preference had been variously explained as due to the position of the fœtus in utero, the position of the vessels on the arch of the aorta allowing a greater supply of blood to one side of the brain than to the other, etc. The most plausible theory that has been urged seems to be that it is derived from the necessity which primitive man found to protect his left side. The left arm becomes the shield or defensive arm, the right the spear or offensive arm. This necessity, continued through countless generations, has caused the differentiation.

Dr. L. S. Pilcher, Brooklyn, N. Y., said:

The Chair remarked that he had hoped to hear some reference on the part of the eminent members of the section upon the relations of the development of the cerebral centers which govern the actions of the hand to the question of dextral preference. It seemed to him that in the laws of cerebral development was to be found the explanation of this phenomenon. He did not think there was any substantial difference in the nutrition of the two sides of the brain, due to the slight differences which measurements had shown to exist in the respective capacities of the blood vessels on the two sides of the neck that transmitted blood to the cerebrum; the freedom of anastomosis that existed within the cranial box favored the uniform diffusion of the blood that was brought to the brain. Nevertheless, he believed that an earlier or more complete development of the centers in the left brain occasioned the more perfect and constant use of the right upper extremity in the various affairs of life. The reflex effect of such preponderating muscular work upon the further development of the nerve-centers that controlled them was a well recognized fact, and from this had been drawn the practical recommendation to begin, at an early date, to exercise the left as well as the right upper extremity, so that the possibilities of disaster in later life from possible degenerations of the developed side might be guarded against by the more equal development of both sides. He invited discussion on this phase of the subject.

LAWS OF THE GROWTH OF THE CELL APPLIED TO HUMAN ANATOMY.

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The human ovum or egg, from which all the tissues and organs of the human body are built up, is in the earliest stages of its embryonic life nothing more or less than a simple cell or mass of protoplasm. These cells or masses of protoplasm are practically identical in all animals and consists, after impregnation, of a fecundating living germ, which has surrounding it a limited supply of food yolk or nourishment, which serves to nourish the embryo until other structures are developed, which carry on the process of nutrition during the entire period of fœtal existence.

As the human ovum is directly transformed during its process of development into the human body, it is obvious that the laws governing the growth of the ovum must furnish the key to the growth of the human body in its adult or completed form. What, then, are these laws, or rather the causes or conditions, which modify the growth of the cells composing the body? The first of these conditions is that cells,

when young and growing, increase in size by layers of nutriment deposited upon the outer surfaces of the cells, accompanied by a nearly equivalent amount of the waste products of the cell, which is absorbed from its inner surface. So long as the amount of nutritive material deposited upon its outer surface is greater than the waste from the inner surface, the cell continues to grow and increase in size until the time of maturity is reached. At this point the forces of waste and destructive assimilation are just balanced by the powers of the organism to absorb and assimilate nutriment.

After this period is reached the individual cells (and in consequence the body as a whole) gradually cease to absorb and assimilate as much of nutritive material as is required to supply the waste, and hence the result of inevitable death, which is the pitiless law that rules the organic world. How, then, does the human body as a whole grow from infancy to maturity? Precisely in the same way as the individual cells of the body do. Take, for instance, the development of the aorta, the great arterial trunk of the body. In the new-born child the aorta is a tube the lumen of which will measure perhaps three-eighths of an inch across; when this same child has reached adult manhood, his aorta will have become a great tube an inch or more in diameter. This increase in size, it is very evident, must have been produced in the way above described. As years pass on numberless layers of microscopic tenuity have been piled up upon its outer surface, thus increasing the thickness of its walls. Along and simultaneously with this process goes on the absorption from the inner walls of the waste tissue, thus increasing its dimensions both externally and internally. This same law of growth is applicable to the development of the intestinal canal with the stomach and accessory organs of digestion, to the growth of the Haversian canals and medullary cavities of bone, to the growth of the shafts of the long bones of the extremities of the body, and, indeed, to the growth of the limbs in their entirety. Not only is this law of growth true of every organ and structure found in the body, but it is just as true when applied to the growth of the human body as a whole.

The second of the causes which modify the shape of the living cells of the body is their tendency to grow towards the source of nutriment. Living cells when free or floating in the liquids of the body are always more or less circular in shape. As found in other parts of the body, they are very variable in size and form. Take, for instance, the cells in the lacunæ or the bone cells; these were originally circular or ovoidal cells. As the process of transformation of cartilage into bone, for instance, goes on, these cells gradually become incased by layers of earthy matter surrounding them, which would prevent the absorption of the pabulum necessary for their nourishment. In order to overcome this difficulty the cells in their process of growth absorb certain portions of the walls inclosing them, and thus the myriads of canaliculi, or fine tubes, which connect the bone cells with each other, and the Haversian canals are formed. The canaliculi are of course entirely too small to admit the entrance of the red or white corpuscles of the blood, or even the blood plaques of Bizzozero, and their nourishment is maintained by the liquid plasma of the blood. Many illustrations of this second cause are to be found in the body. It is only necessary here to mention the rapid repair of fractures of the long bones, when the fracture occurs just below the point where the nutrient artery enters the bone, as compared with the slowness of repair when it occurs just above (thus partially cutting off the circulation of blood in the part). In fact, it is universally admitted that the growth and development of every organ and tissue in the body is directly proportioned to the amount of its blood supply.

The third cause modifying the form of the cells of the body is that each cell and the body as a whole tend to reproduce, under favorable conditions, the same type of the parent cell from which it sprang. Bone tends to reproduce bone. Muscle reproduces muscle, and so, in like manner, do all the tissues and organs of the body.

In pathologic growths we do find alien and foreign tissues in the diseased portions of the body. Bone, for instance, is often found in epidermoid cysts, and in parts of the body which in health are composed of cartilage and muscle.

One important fact, however, is to be noted in studying the constituents of pathologic growths, and that is that all pathologic growths are histologically true to the class of tissues generated by the layer of the embryo from which they were originally formed. As is well known the human embryo primarily divides into two layers, the ectoderm or epiblast and the endoderm or hypoblast. A third layer is afterwards developed between these which is called the mesoderm or mesoblast. Tissues, therefore, which originally sprang from the first two primary layers of the embryo, do not tend to reproduce the tissues which are formed from the mesoderm or middle layer of the embryo. The exceptions to this rule are rare.

The fourth cause or condition, modifying the shape and growth of cells, is the pressure of other cells upon them during the early period of their growth. The multiform shapes of the cells found in cancerous tumors are evidently due to this cause, as well as the flattened shape of the cells found in the epidermis, hair, and many other parts of the body.

After maturity, the retrograde change or metamorphosis at once begins in the cells, and as a necessary consequence in the body as a whole. The powers of assimilation of nutriment gradually become insufficient to supply the waste, and hence the body as a whole tends to emaciate. Not only is this the case, but the power of the individual cells to separate the waste materials which are the results of their nutrition, become impaired. These waste materials of the cells as a consequence accumulate and cause thickening of the cell walls of all parts of the body. One of the most striking of the results of this process is seen in the hardening and calcification of the arteries of the body, which is so commonly found in persons of advanced age. The tissues themselves tend to degenerate in old persons. Muscle becomes degraded into fat, and the same degenerative process invades the connective and other tissues of the body. A familiar example of this is to be found in the arcus senilis, which is a sure sign of the degeneration of the tissues.

It may seem, perhaps, necessary to apologize to an audience like this for such an elementary sketch of the growth and development of the human body. My object in doing so has been to call attention to what I believe to be our unscientific method of teaching human anatomy, as it is usually taught in our medical schools and colleges. The most usual or ordinary method of teaching human anatomy is to begin by studying the bony framework of the adult human body. This has always seemed to add unnecessary complexity to the study, and prevents the student from grasping the real simplicity of the idea of the structure of the human body when studied from the point of view of its being simply a development from the human ovum or cell. The study of the various organs of the body also is much better commenced by examining them, with the aid of the microscope, as the same organs are found in the lower order of animals. The kidney, for instance, in man is quite a complicated organ, many of the parts of which it is difficult for the student to understand. In the common newt it is composed simply of a layer of tubes which can be studied and comprehended by the student with comparative ease. What is our plan in pursuing other studies? If we, for instance, take up the study of chemistry, we never begin by studying the complex compounds first; on the contrary, we first study the elements out of which the complex bodies are formed, and thus proceed from simplicity to complexity. The same method is adopted if we take up the studies of botany, geology, mineralogy, or, in fact, any of the branches of natural science. Why, then, do we adopt a different method in the study of human anatomy from the one we adopt in studying all the other branches of science? My idea of the true way to study human anatomy, then, would be to begin by studying the human ovum or cell, then the fluids, such as the blood and lymph in which the cells are found free and floating. After this study the changes produced in the ovum by impregnation, the segmentation of the ovum, with the development of the blastodermic membrane of the embryo and its further division into the external and internal layers. Study, then, the tissues and organs formed from these layers in the order of their development. Then take up the study of the middle or third layer of the embryo, with the

tissues and organs formed from it. The study of human anatomy carried out in this way gives to it a simplicity and beauty that renders it worthy to be classed among the exact sciences.

It may be here remarked that this method of teaching anatomy is not a new or untried one. Prof. Piersol, of the University of Pennsylvania, I am informed, teaches human anatomy in a manner essentially the same to the one above described, and the writer, a number of years ago, when professor of anatomy in Georgetown University, adopted with success the same plan.

DISCUSSION.

Dr. John B. Roberts said:

The teaching of anatomy is, as the author has said, usually taught in an unscientific manner, because the complex human body is studied by students who know nothing of biology. The true method is to begin the study with simple forms, vertebrate and invertebrate.

Dr. West said:

In reply to Dr. Robert Reyburn's most able paper on laws of the growth of the cell applied to human anatomy, in which he suggests that the proper mode of teaching anatomy is to begin with the cell structure (histology or general anatomy), I agree with him perfectly, but the question comes up, under whose chair does this important branch of anatomy come. I claim that it does not come under the chair of anatomy, whose duty it is to teach descriptive and special anatomy, but it properly comes under the chair of physiology or that of normal histology, which chair every medical college should have, armed and equipped with a microscope as well as everything else pertaining to the proper teaching of that chair, which I consider as important as any other chair in a well-equipped medical college. The professor of anatomy proper, that is of descriptive and general anatomy, has just as much as he can attend to and more besides, to do justice to his subject in the short space of time (two years) given him. He would be getting into deep water to begin with such a task, covering so vast a field as it does.

ON THE RECENT OCCURRENCE OF LINGUATULA RHINARIA, RAILLIET, 1886, AND TÆNIA ECHINOCOCCUS, V. SIEBOLD, 1853, IN THE UNITED STATES OF NORTH AMERICA.

By CHARLES W. STILES, Ph. D.

Medical Zoologist, Bureau of Animal Industry, U. S. Department of Agriculture, Washington, D. C.

I wish briefly to call attention to two parasites, comparatively rare in this country, found both in man and domesticated animals.

The first one, *Linguatula rhinaria* (*L. serrata, Pentastoma tænioides*), is by no means uncommon in Europe and has been reported several times in South America. Until recently, however, it has not been noticed in the United States. F. L. Kilborne, B. V. S., of the Bureau of Animal Industry, found eight specimens in a rabbit at Washington, D. C., several years ago (Curtice, Journal of Comparative Medicine and Veterinary Archives, 1892, p. 231), and Dr. Cooper Curtice found one specimen in another rabbit in this city (Curtice, *l. c.*). These two finds are, so far as I have been able to learn, the only cases on record of this parasite in North America.

Quite recently (July 3, 1893) my colleague, E. A. Schrœder, M. D. V., in making post-mortems on cattle at the Soldiers' Home, in the District of Columbia, observed a peculiar appearance of the mesenteric glands and, upon cutting them open, he discovered an organism which he suspected belonged to the species now under consideration. The parasites (forty in all) were present in three different steers. Dr. Schrœder kindly turned the material over to me for final diagnosis and I instantly confirmed his specific determination.

As the rabbits and cattle mentioned above were all raised in this region, the finding of these parasites proves conclusively that the infection took place in this vicinity, or in other words, that the adult from this parasite is present in dogs in the district. This is a point of considerable interest to physicians, since man is subject to infection by this parasite.

It is not my intention to give an exhaustive account of this subject, as the species in question has already been worked up by my European colleagues, and as I have already published on this same matter myself. As this arachnoid is, however, comparatively unknown in North America, it will perhaps be in place for me to give a very brief summary of the biology of the subject.

The specimens which I now exhibit to you measure 4 to 6 mm. in length. These represent the larval stage generally known as *Linguatula serrata* or *L. denticulata*, which is found in the liver and other viscera of herbivorous animals. It has also been found in the domestic cat. If these parasites gain access to the nasal cavities of dogs, they develop into the adult stage known as *Pentastoma tænioides*, which grows to the length of 18 to 26 mm. (male) or 70 to 130 mm. (female). The animals copulate, and the female produces an immense number of eggs, which escape with the nasal mucus of the host. Each egg contains a minute 4-legged embryo, which in turn develops into the larval stage upon being swallowed by a herbivorous animal.

The species can be recognized by the following external characters: The animals are more or less flat dorso-ventrally; they possess about thirty transverse rings; on the ventral surface of the anterior portion in the median line is situated the mouth, and on each side of the latter are to be found two hooks; the vulva is posterior, while the male opening is just caudad of the mouth.

The life history as given above is the usual and most simple cycle, but is subject to several exceptions. As I have treated these exceptions in detail elsewhere (Sur la Biologie des Linguatules, Compt. rend. de la Soc. d. Biologie, Paris, 1891, p. 348), I will note here only one or two cases which seem to me the more important from the standpoint of the practitioner.

In cases where men have harbored this species, it seems incontestable that the infection has generally taken place in one of the following ways: (1) By obtaining the embryos directly from dogs infested with the adult form; (2) by swallowing embryos with the drinking water; (3) or by eating vegetable food which has been soiled by the nasal discharge of dogs.

All authors seem to agree upon these three modes of infection. Personally I have suggested a fourth (*loc. cit.*) mode of infection, based partly upon theoretical grounds, partly upon observations and experiments with an allied species (*Porocephalus crotali; Pentastoma proboscidium*). If larval forms of this latter species are fed to snakes, some of the specimens reach the lungs, while others simply bore through the intestinal walls and become encysted in the body cavity. Theoretically the same must apply to *Linguatula rhinaria*, that is, if a man should eat a piece of liver or other organ containing living specimens of this species, it is perfectly possible that some of the parasites would bore their way to the abdominal cavity and be found later in that place.

Carrying the matter further, I prophesied two years ago (*loc. cit.*) that *Procephalus crotali* would one of these days be found as a parasite in the opossum (*Didelphys virginiana*), and as a chance parasite in the American negro, the latter receiving his infection from eating the opossum. The first part of my prophesy has already been fulfilled, for my assistant, Dr. Hassall, and I have recently found this parasite in several opossums, and Leidy some years ago made a similar find, which was not known to me at the time I wrote the article referred to.

I can hardly leave this subject without referring to Babes' theory in regard to the wanderings of *Linguatula rhinaria* in cattle. He believes that the parasites bore from the abdominal cavity into the lumen of the intestines, are expelled with the fæces, and are afterwards taken up from the ground by dogs. As I have stated elsewhere, this seems perfectly possible, but certainly can not be looked upon as the

general mode of infection, for I have convinced myself by repeated experiments that the larval tongue-worms may develop in the intestinal wall. Now, when they burst their cysts, they will unquestionably fall into the abdominal cavity, or into the intestine, according to the direction of least resistance.

The second parasite to which I wish to call your attention, is *Tænia echinococcus*. It is well known to you that the larval stage (*Echinococcus polymorphus*) of this parasite is more or less common in certain countries, and that a number of cases have been reported in man in this country. Most of the cases found in man in this country have, however, been in foreigners. We have also four cases on record of its occurrence in American hogs (Welch 3, Moore 1), and one case in cattle (Stiles). These cases in domesticated animals, as well as the cases in Americans who have never left the country, demonstrate that the adult tapeworm is present (though rare) in American dogs; in fact F. L. Kilborne has found it in one dog in this city (Curtice, *l. c.* p. 231).

Quite recently reports have come to me that the echinococcus hydatid is very prevalent among Texas cattle, and surprise has been expressed that it has not been found more frequently in man in that State. It is in order to explain this apparent inconsistency that I mention this parasite at present.

Within the past two months I have had no less than 30 cases of this "Texas echinococcus" referred to me, and I have personally examined no less than 5,000 Texas cattle for this species, and after a most thorough study of the various specimens diagnosed as echinococcus hydatids I can state positively that not a single one of the cases I have examined represents an echinococcus.

The pathologic specimens have, indeed, a superficial resemblance to the parasite in question, but when opened are found to be abscesses.

At the request of Dr. V. A. Moore, I made bacteriologic cultures from the abscesses, and we may expect from him a report on the exact nature of the trouble. In the meantime we can rest assured that the reported prevalence of echinococcus hydatids in Texas cattle is greatly exaggerated and that we have no reason to fear that this parasite will become prevalent among the inhabitants of that State. By this, of course, I by no means state that there are absolutely no cases of this parasite in that region. I only say that none of the cases referred to me under the diagnosis given represented hydatids.

A NOTE ON THE OCCURRENCE OF THE SCAPULO-CLAVICULAR MUSCLE.

By ROBERT ORTON MOODY, B. S., of New Haven, Conn.

Last January at Yale Medical College, while dissecting the left shoulder of a male subject, I found this anomalous muscle, the scapulo-clavicular. A careful study of the literature on the subject of muscular anomalies revealed the fact that the recognized occurrence of this muscle is very rare. I could discover no record which showed that the muscle had ever been found in this country.

Dr. L. Testut, in his excellent work entitled Les Anomalies Musculaires Chez L'Homme, describes its occurrence in two subjects. He says it also has been described by Wood and Gruber, and that its occurrence has been noted by Luschka, MacWhinnie, and Hallet. So careful an observer as Macallister declares that he has never found it.

The scapulo-clavicular muscle is an incomplete form of the sterno scapular muscle, which, anomalous in man, is constant in many species of vertebrates, reaching its highest development in the Pachyderms and Ruminants, notably the hippopotamus, the elephant, the pig, the donkey, and the horse.

If the clavicular attachment of the scapulo-clavicular muscle were prolonged a few centimeters mesiad (toward the median line), it would become a sternal or costal insertion, and the muscle would then be a complete form of the sterno-scapular muscle.

Muscles homologous to the scapulo-clavicular muscle in man are found in a large number of mammals. Wood has found this muscle well marked in the rabbit and the Guinea pig. Cuvier and Lorillard have figured it in their atlas under the name of "scapulo-clavien."

The muscle which I found was 7 centimeters in length. Its diameter in its fleshy portion was about the same as the diameter of the fleshy portion of the posterior belly of the omo-hyoid muscle in that subject. It took its origin from the superior border of the scapula by a tendinous margin, in common with the attachment of the internal portion of the posterior belly of the omo-hyoid, and by a slender tendon, which was continuous with this tendinous margin, and which extended mesiad to within 1 centimeter of the superior angle of the scapula. In its scapular two-thirds it was internal to and parallel with the posterior belly of the omo-hyoid. At the junction of the scapular two-thirds with the clavicular third, it passed beneath the omo-hyoid muscle and continued parallel with the posterior surface of the clavicle to be inserted by a well-marked tendon into the clavicle at the junction of the posterior border with the rhomboid impression.

It is in relation dorsad, or internally with the suprascapular artery and nerve, the serratus magnus muscle, the axillary artery and vein, and the brachial plexus; superficially with the omo-hyoid muscle and the clavicle.

THE VERMIFORM APPENDIX.

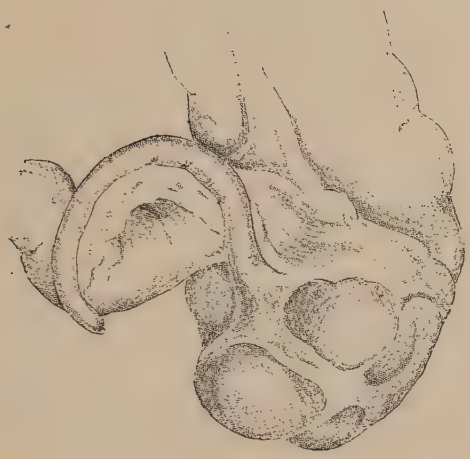
By R. H. PLUMMER, A. M., M. D., M. R. C. S., of England.

Professor of Anatomy, Cooper Medical College; Chief of the Surgical Clinic and of the Genito-Urinary Clinic, Cooper Medical College, San Francisco, Cal.

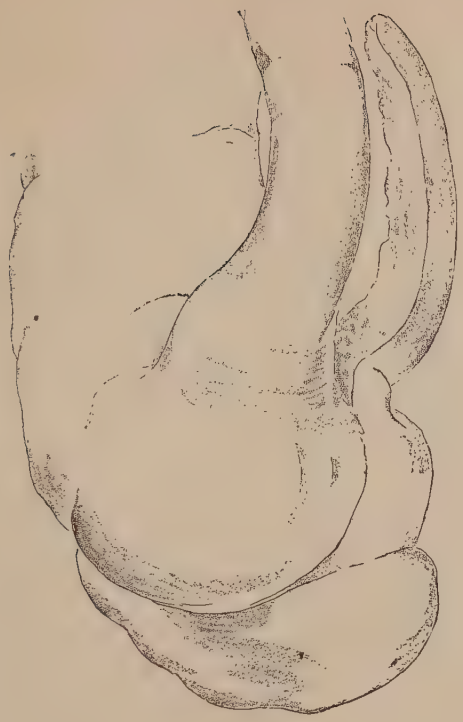
The field for anatomical literature is so limited by the fixed laws of nature, and so well have these been conned, that ground for new material is found only in deviations from the usual type, which curtails the work in this department.

Not many years since health statistics teemed with reported cases of so-called "idiopathic peritonitis," but the cause became more apparent as post-mortem examinations revealed, in many cases, suppuration, perforation, or gangrene in the vermi-

form appendix, sometimes with a stercolith (coprolith) or some foreign substance, as the seed or stone of fruit, lodged therein. This knowledge has invested the appendix with new interest to the surgeon, the chief points of which are, first, its form and attachments; second, its situation and relations, having reference to operative measures. It is usually described as a "blind, worm-like tube" arising from the inner and posterior part of the cæcum, near the ileo-cæcal valve, passing thence upward and inward behind the cæcum. Extended observations, however, have demonstrated that its form and attachments vary not a little. It may arise from the posterior, the internal, or the anterior surface, or from the apex of the cæcum, the longitudinal muscular bands which characterize the large intestine being continued upon it. In some of the latter cases it appears as a funnel-form prolongation of the cæcum downward and inward somewhat as represented in the above sketch.



VERMIFORM APPENDIX.



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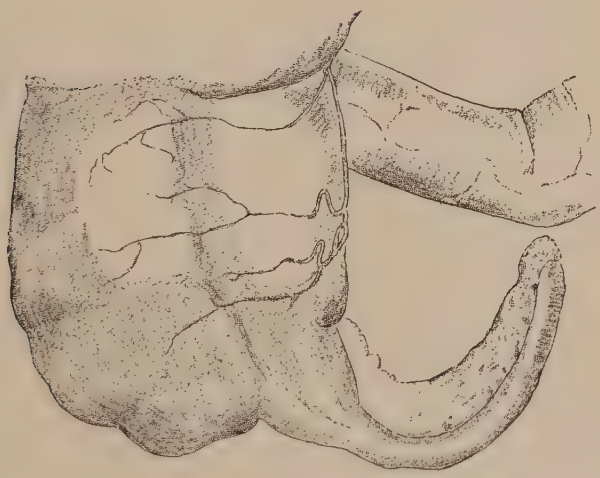
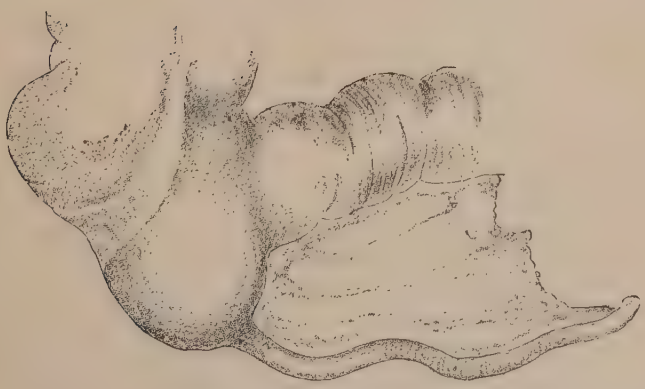
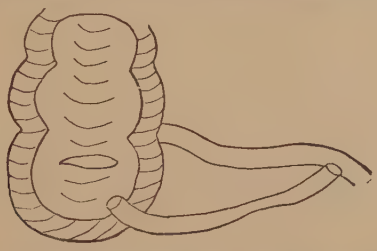




VERMIFORM APPENDIX.

But the variation in form and attachments to which I desire to direct special attention, since I have not seen it described elsewhere, is one recently discovered in the anatomical room by one of my prosectors, Mr. Lawrence Boido. It was found to have its origin from the inner margin of the apex of the cæcum, passing thence downward and inward, crossing the brim of the pelvis, dipping somewhat into its cavity, thence ascending until it reached the ileum, about four inches distant from the cæcum, where it opened into its posterior-inferior border. It is nearly seven inches in length and about the size of a goose quill, except the last two inches, where it is dilated to about twice that size. The orifice of entrance into the ileum is somewhat constricted, but freely admits an ordinary probe.

The following sketch represents the cæcum open from the front, exhibiting the slit-like orifice of the ileum, just below which, in the apex, is the smaller opening of the appendix, showing, also, its course and attachment to the ileum.



The subject from which this specimen was taken was a German, male, laborer, sixty-two years of age, and died of pulmonary tuberculosis. So far as known he presented no history of abdominal trouble, nor was there any evidence, on post-mortem examination, of previous inflammation which might have resulted in adhesion and perforation into the ileum.

The chief interest attached to its variation in position has reference to the facility and safety of operative procedures. In 30 per cent of the large number of cases examined the cæcum has been found resting upon the psoas near its outer border on a line and midway between the umbilicus and the anterior-superior spine of the ilium. In the remaining cases it occupied various positions, viz: External to the psoas, resting upon the iliacus, lower or higher than the point above designated, or toward the pelvic cavity, reaching sometimes to, or even beyond, the median line.

The variation may depend upon the mode of development, or it may depend upon the length of the meso-cæcum, when that exists; and it is not always possible to accurately determine the position before operating. In one hundred cases examined only 26 per cent are found to have a mesentery, the peritoneum merely covering its

Stump slit down. Trimmed flaps. Flaps invaginated and sutured.

anterior surface in the other cases. When the cæcum occupies the iliac fossa the appendix may be reached with greatest facility and safety through the ordinary semilunar incision for ligation of the external iliac artery. Frequently it will be found unnecessary to open the peritoneal cavity, thus lessening the danger by reason of the bowel being uncovered on its postero-external surface. If, however, during the operation the case be found to be one where the cæcum lies higher in the cavity, or where there is a mesentery which permits more or less movement toward the median line, it may still be readily reached by extending the incision upward and

inward toward the umbilicus. In removal of the appendix the closure of the lumen may be effectually accomplished by slitting down the sides of the stump and trimming the angular corners of the flaps, which may then be inverted or invaginated, thus bringing the serous surfaces together, where they may be sutured in position.

DISCUSSION.

Dr. Lamb said that in his post-mortem experience the cæcum was generally covered with peritoneum, except, perhaps, a portion of the posterior surface. The vermiform appendix has also been generally covered with peritoneum, of very varied length, anywhere from 2 to 8 inches, and many times twisted and angled, sometimes with adhesions. In the case of Dr. Stiles, Dr. Lamb thought that probably there had been an accumulation in the terminal portion of the sharply-bent appendix, and set up inflammation. Dr. Lamb remembered having seen but one case in which the appendix was absent. It was astonishing to notice how small an amount of disease of the appendix was apparently sufficient to cause death.

THE RELATIONS OF THE HEART AND LUNGS TO THE ANTERIOR CHEST WALL AS DETERMINED BY COMPOSITE PHOTOGRAPHY.

By IRVING S. HAYNES, PH. B., M. D.,

Demonstrator of Anatomy in the Medical Department of the University of the City of New York, Member of the Society of the Alumni of Bellevue Hospital, of the New York County Medical Society, of the Association of American Anatomists, etc.

The study of the relations of the heart and lungs to the anterior chest wall is of the utmost interest to us, not only as anatomists searching after the exact relations of the various parts of the human body, but also as surgeons and physicians engaged in the treatment of these organs in their various morbid states; for how can a departure from the normal relations of the body be detected unless we are familiar with those relations?

It is practically impossible to determine the surface relations of the heart and lungs in the living except in the most general way, and we are forced to study out the problem upon the cadaver. After we have obtained our post-mortem measurements we can not apply them indiscriminately to the living individual. Due allowances must be made for the constantly changing positions of the heart and lungs with every pulsation of the former and respiration of the latter, for the changes caused by the different positions assumed by the individual or produced by the states (physiologic or pathologic) of the neighboring viscera (stomach, liver). The varying thickness of the superficial tissues and the sexual peculiarities of the chest and mammary configuration must also be taken into account.

Notwithstanding all these difficulties with which we must contend, our post-mortem results do admit of the most practical application, and, when the necessary corrections of age, sex, posture, etc., are made, become of such reliability as to deserve our confidence.

Of the methods heretofore employed for determining the surface positions of the heart and lungs, I will speak briefly of two, namely, transfixion and frozen sections.

Transfixion by long pins is a method subject to many sources of error, and in the end becomes a good deal like guesswork; for, unless the differences between the positions of the pins and the actual position of the viscera under consideration are correctly taken and referred to corresponding points upon the chest, the results from this method will be too uncertain to be depended upon. Frozen sections, carefully made as directed by Prof. Thomas Dwight, will give correct results, but the method is very laborious, takes a great deal of time, can be used only at a certain season of the year, and then only in favorably situated places.

In the face of these difficulties, and with the confusion of mind following a hasty comparison of the measurements given in some of the standard text-books, I cast about for some way of determining these relations for myself, rapidly, accurately, easily, and without reference to place or season, and thought of my camera as a faithful agent to fulfill these diverse requirements.

Composite photography has been applied to the solution of other problems, but I think I am the first to apply it to the determining of the external relations of the heart and lungs. I began my experiments in May, 1893, and would say in this connection that I have applied the same method to solving the abdominal relations with most satisfactory results, which I hope to be able to present to the society at some future occasion.

Before entering upon a description of composite chest photography, I wish to digress for a moment to offer a few comments upon the text-book literature of the subject and to make a plea for greater exactness in such works.

I do not contend that the statements of the various authors must agree with one another—that is impossible from the very nature of the subject—but I wish to object to the sweeping general statement that on close study furnishes us with so very little reliable information. As an example of this style, I quote the following verbatim from a text-book of anatomy: "The heart lies upon the tendinous center of the diaphragm, its base pointing upward and backward, and its apex pointing at the junction of the fifth rib and cartilage." And this is all there is in the entire volume respecting the location of such an important organ as the heart.

Again, I wish to call attention to rules apparently so exact, but really hiding many perplexities, and for the first illustration I shall quote, with all respect, from that storehouse of anatomical information, Quain's Anatomy, Vol. II, ninth American edition, page 493, the following: Speaking of the left border of the heart, and where to draw its outline upon the chest, he says it is indicated by a "line from the third cartilage," etc. Now, the third cartilage is anywhere from 1½ to 2½ inches long, about three-fourths of an inch wide. How can such an area be the starting point of a line? One more: Quain and Gray both give the base of the heart as a "line drawn across the sternum on a level with the second costal cartilages." Might we not with propriety ask, Is the upper border or the center or the lower border of these cartilages meant?

Many errors in our text-books are excusable, but I offer that in text-books primarily intended for students, and designed to be as concise and accurate in statement as is consistent with brevity, serious omissions should not be covered by a few generalities, nor should "points" mean any dimension of length up to an inch or any dimension of surface from its proper definition up to an area of 1 or 2 square inches. Again, we meet with difficulties in the application of these statements, however accurate, to the individual. For while in a thin person it is easy enough to recognize cartilages and ribs, when these landmarks are covered with even a moderate layer of fat their recognition becomes uncertain, to say nothing of locating the costo-chondral and chondro-sternal articulations. If I might offer a plan to assist in fixing the relations of the thoracic viscera to the exterior of the chest in connection with the usual landmarks of sternum, ribs, cartilages, and their articulations, I would suggest that we start from the supra-sternal notch and mark the distance to below the ensiform along the median line in inches or centimeters, and the distance of points transversely to the right or left of this line to be given with the distance on the mid-sternal line (from the supra-sternal notch) from which the lateral lines are drawn.

For example, the apex point in Subject I is 2¼ inches transversely to the left of the mid-sternal line (which will be referred to by the letters M. S. L.) at its 7-inch point, i. e., at the point 7 inches from the supra-sternal notch. No matter how thick the layer of adipose tissue is over the chest, and how obscure the cartilages and ribs in consequence become, the supra-sternal notch can always be accurately

determined by the same manœuvre—only reversed—by which the anterior superior iliac spine is fixed; namely, by carrying the thumb from above downward into the notch until it comes in firm contact with the upper margin of the sternum, and from this point make the downward measurement. The measurements to right or left must always be made at right angles to the mid-sternal line.

Source of error.—Of course, all chest walls and their contained viscera do not have the same dimensions, and it would be obviously incorrect to apply the results obtained from a large subject directly to a small one. Yet, after the measurements for the average male and female adult are obtained, these can be applied to the determining of similar points in the average person, and the extremes of our scale in the one case to the extremes in the other. Perhaps we can subsequently determine a certain ratio between the chest measurements and its circumference or some other representative measurement that will help us to overcome the above source of error, but my experiments have not yet been sufficiently numerous to justify the formulation of any reliable suggestion in this connection.

Directions for taking the composite chest photographs.

Place the subject perfectly horizontal and inject carefully through the carotid (right or left) a thin plaster mixture (colored if desired) to moderate fullness. Some subjects should be used without the injection, but the injection when moderately given, and after it has firmly set, serves to maintain the heart in a fixed position, and is consequently an advantage. Moreover, by distending the heart moderately, as is usually the case, its natural position in diastole will be closely approximated (Subject I) and in those instances where the injection does not fill the ventricles and they happen to remain firmly contracted, you will secure the heart in a state closely allied to its condition during systole (Subject II). Locate the position of the nipples with reference to the ribs and mid-sternal line as previously described, then carefully incise them through their center to the deep parts and mark such places with an aniline pencil so they may be found later on. Remove all superficial tissue and muscles (pectorals and abdominal) over an area sufficiently large to expose the entire chest from above the clavicles to below the lower ribs and from side to side as far as the anterior axillary lines. Expose the trachea, cut it in two below the thyroid cartilage, insert a rubber tube into it, and connect with the bellows or pump. Thoroughly clean the ribs, cartilages, sternum, external intercostal muscles, clavicles, and the origin of the sterno-cleido mastoids. Now place a narrow tape measure or a strip of white paper, upon which the inches have been marked, from the upper margin of the sternum (suprasternal notch) along the middle line to below the ensiform appendix. Upon each cartilage and rib indicate the distance in inches, measured transversely from the mid sternal line, by narrow strips of white paper as long as the cartilage or rib is wide and placed vertically upon the same to the number of 4 or 5 on either side of the middle line. These strips of paper will help very much in determining the position and direction of the various ribs and cartilages. Set up the camera vertically over the subject, focus on the nipple points (indicated by small circles of white paper), and fix the focus with the set screw. You will need two double plate holders A and B, and very slow plates, numbering the slides A 1 and 2, B 1 and 2. Take the chest in expiration on plates A 1 and 2. (Expiration, first exposure.) The time of this exposure must bear the ratio to the full exposure of about 1 to 3. Inflate the lungs to moderate distention, counting the number of bellows' or pump fulls, and expose plates B 1 and 2. (Inspiration, first exposure.) Let the air escape from the lungs. Remove the sternum from the lower level of the first cartilage to the upper border of the seventh, the included cartilages and ribs for a distance of 4 or 5 inches from the median line. Do not open the pleura. Now inflate the lungs with the same number of bellows' or pump fulls as before.

SUBJECT I.

No. 1.—COMPOSITE PHOTOGRAPH OF CHEST AND HEART; HEART EXPANDED.

Pericardium removed.

SUBJECT I.

No. 3.—COMPOSITE PHOTOGRAPH OF CHEST AND LUNGS IN INSPIRATION.

Pleuræ unopened

Expose B 1 (inspiration, second exposure; pleura not opened).—Open the pleural sacs and remove the anterior portions.

Expose B 2 (inspiration, second exposure; pleura removed).—Allow the air to escape from the lungs.

Expose A 1 (expiration, second exposure; pericardium intact).—Remove the presenting portion of the pericardium from heart and great vessels.

Expose A 2 (expiration, second exposure; pericardium removed).

These photographs will give you the position of the lungs, with and without their pleuræ, and of the heart, with and without its pericardium, upon the chest wall from which the necessary measurements can be accurately determined.

By the preceding method the following relations were obtained:*

Subject I.—Adult male negro, apparently about 35 years of age; cause of death unknown. Subject had been injected with chloride of zinc and starch color mixture originally for another purpose, but was used for this experiment.

(A) Nipples: Located over the lower half of the fourth rib, 3½ inches transversely from the mid-sternal line (and at a point on that line 5 inches from the suprasternal notch) both alike.

(B) Heart: This organ had been distended by the injection, and approximately represented the heart in diastole. Its relations were as follows:

(1) Base: This is taken as the upper limit of the heart. It is indicated by a line drawn across the sternum from just below the middle of the second intercostal space on the right side, 1¼ inches from the mid-sternal line (at its 3 I. P.) to the left to cross the median line (at the 2¾ I. P.) and end at the upper portion of the second left space, 1½ inches from the mid-sternal line (opposite its 2⅝ I. P.).

(2) Apex: Behind the center of the fifth interspace 2¼ inches to the left of the median line (at its 7 I. P.).

(3) Left border: From the left extremity of the base line downward and slightly outward to cross the third costal cartilage 2 inches from the M. S. L. (at its 3⅝ I. P.). It continues downward and outward until the fourth interspace is reached, then turns inward as it passes to the apex point. This line crosses the fourth left costo-chondral articulation, which is 2¾ inches from the M. S. L. (opposite its 5 I. P.), the fourth interspace at the center of which it is 2⅞ inches from the M. S. L. (at its 6 I. P.); from here it curves downward and inward, crosses the fifth cartilage 2¾ inches from M. S. L. (opposite the 6⅝ I. P.), and ends at the apex (*see* 2).

(4) Right border: Begins at the right end of the base line passes outward and downward across the third right costal cartilage 1½ inches from the M. S. L. (at 3½ I. P.) over the third interspace and fourth costal cartilage 1¾ inches from the M. S. L. (the former opposite the 4⅜ and the latter the 5 inch points, respectively). It now curves downward and inward, and terminates over the center of the fifth costal cartilage 1⅝ inches from the median line (at 6 I. P.).

(5) Lower border: This joins the lower ends of the right and left borders. In doing so it describes a wavy course, with a concavity at each end looking upward, and one in the center, as it crosses the middle line, looking downward. It crosses the sixth and seventh right costal cartilages transversely to their long axes, the median line at its 6¾ I. P., over the middle of the ensiform, and the seventh left costal cartilage very obliquely to reach its lowest point at the lower margin of the sixth costal cartilage, 1¼ inches to the left of the M. S. L. (at 7½ I. P), then turns abruptly upward to join the lower extremity of the left border at the apex.

(C) Auricles.

(1) Right: Its upper and outer (right) borders are formed by the portions of the base and right border lines of the heart cut off by a line which forms the inner (left) border of the auricle, and which starts from the base line one-fourth of an inch to the right of the median line and passes directly downward until opposite the lower border of the third right costal cartilage (at the 3⅝ I. P. on the M. S. L.); from this point it curves slightly downward, passing outward about parallel with the lower margin of the third costal cartilage, until 1 inch from the M. S. L. (opposite the 4 I. P.), when it turns more abruptly downward and intersects the right border of the heart at the upper margin of the fourth costal cartilage.

(2) Left: This shows us only a very small half-moon shaped space bounded above and on the outside by small adjacent portions of the base and left border of the

* When a border of the heart or lungs is said to cross a cartilage or intercostal space at a certain distance from the median line the measurement is always made from the center of the cartilage or space unless otherwise stated. The mid-sternal line will be referred to by its initials M. S. L., and the numeral following it in parenthesis, as "at 6 I. P." means at the 6-inch point on the mid-sternal line. measured from the suprasternal notch as already described.

heart. Its inner margin is indicated by a line drawn from a point on the base line 1 inch from the left of the M. S. L. and curving downward to intersect the left border, where it crosses the center of the third cartilage.

(D) Auriculo-ventricular groove: The two extremities of the line indicating this groove correspond to the lower halves of the inner borders of the auricles. The central portion to a line connecting the middle points of these borders and curving slightly upward as it crosses the sternum. This middle portion indicated the line of junction of pulmonary artery and right ventricle.

(E) Coronary arteries.

(1) Right: Runs from the middle point of the inner boundary of the right auricle 1 inch from the median line downward in a nearly straight course to the lower border of the heart three-fourths of an inch from the M. S. L.

(2) Left: This begins similarly at the midpoint of the inner margin of the left auricle and descends almost vertically and about 1¼ inches from the mid-sternal line to the lower border of the heart.

(F) Long axis of the heart: Reaches from the right end of the base line to the apex. It crosses the mid-sternal line (at its 4½ I. P.) opposite the centers of the sternal ends of the fourth cartilages.

(G) Area of cardiac dullness during inspiration: It is a quadrilateral space, bounded on the right by the median line; below by the lower border of the heart; above by a line drawn from a point on the mid-sternal line (4½ I. P.) opposite the centers of the sternal ends of the fourth cartilages along the upper margin of the fifth left cartilage 1¼ inches from the M. S. L. (opposite its 5¾ I. P.); and on the left by a line from the last point downward and inward to cross the lower border of the heart three-fourths of an inch to the left of the median line. Roughly stated this area is an inch and a quarter wide to the left of the median line, limited above by the upper margin of the fifth left cartilage, and below by the lower border of the heart.

(H) Aorta: Its axis corresponds to the median line as far as it is shown in the photograph. Its right border being one-half inch to the right and its left the same distance to the left of the median line, the former reaching from the base (one-half inch to the right of the M. S. L.), and the latter appearing above the pulmonary artery and both disappearing under the upper sternal fragment.

(I) Pulmonary artery: This occupies the intervening space between the auricles and is limited below by the line for the auriculo-ventricular groove. It is about 1¼ inches wide at its base and extends above the base line about one half inch where it disappears under the aorta. It conceals the origin of the left portion of the aorta.

(J) Superior vena cava: This shows as nearly vertical and three-fourths of an inch wide along the right side of the aorta. Its right border begins from the point of intersection of the right heart border and the upper margin of the third costal cartilage, and passes directly upward to disappear under the upper sternal fragment. Its left border is indicated by the same line as the right margin of the aorta.

(K) Lungs: In inspiration (moderately inflated) and contained within the unopened pleuræ. Their anterior edges alone traced.

(1) Right: The anterior border of the right lung is nearly vertical for a considerable part of its extent. It appears (in the photograph) issuing from beneath the upper fragment of the sternum opposite the 1½ I. P. of the M. S. L., and distant from it one-half inch to the right. It passes downward and inward to cross the mid-sternal line at its 1¾ I. P. (opposite the first interspace) and reaches one-fourth inch beyond the center line toward the left. From here it descends vertically parallel with and one-fourth inch from the middle line until on a level with the center of the sternal ends of the fifth cartilages (opposite the 5 I. P. on the M. S. L.), where it turns to the right, crosses the median line, and passes downward and outward, following the direction of the upper margin of the sixth cartilage.

(2) Left: Its outline is more irregular than the right, as it has a large notch for the accommodation of the heart. Like the right, it comes out from the upper portion of the sternum the same distance to the left of the middle line at the same point (1½ I. P.), passes downward toward the right and meets the right lung on a level with the upper border of the second costal cartilages (opposite the 2 I. P. on the M. S. L.). From here the inner borders of the two lungs (separated only by the pleuræ) remain in close contact until opposite the middle point between the fourth cartilages (4½ I. P. on M. S. L.), when the left lung abruptly leaves the other and passes outward and downward parallel with the upper border of the fifth costal cartilage until 1¼ inches from the M. S. L. (opposite its 5¾ I. P.); it now passes downward and slightly inward until the sixth cartilage is reached, which it follows outward to the left along its upper margin.

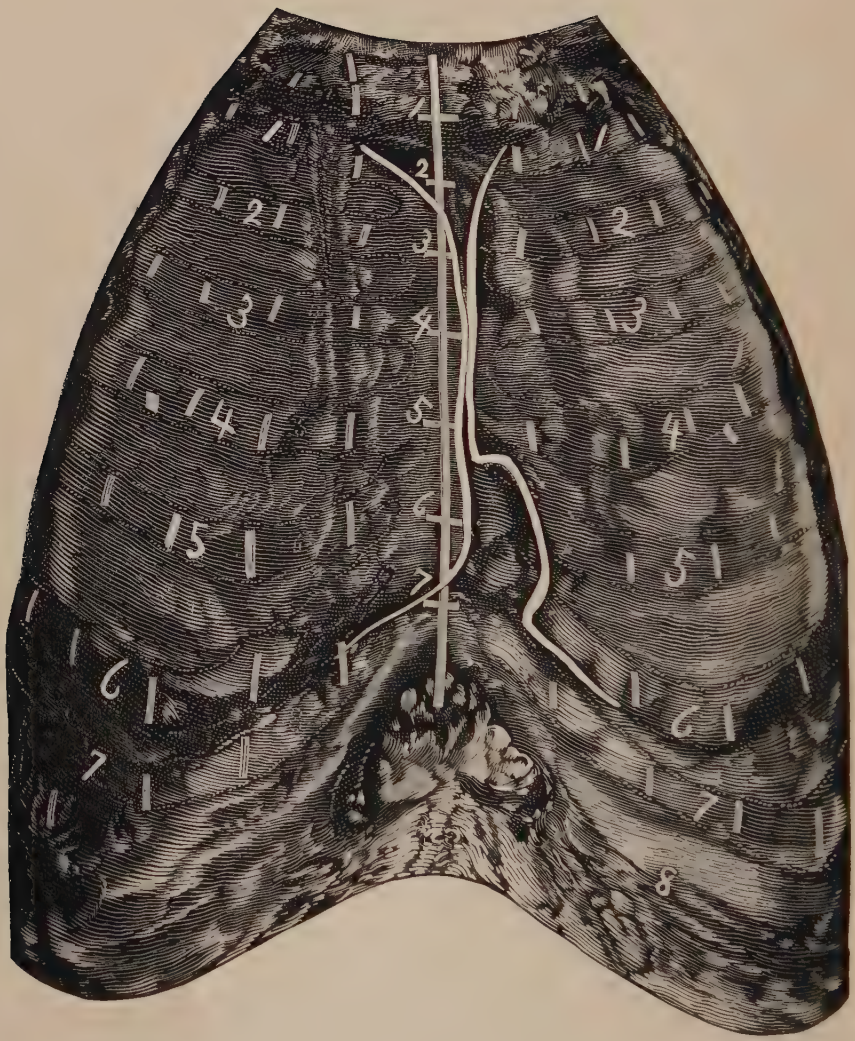
(3) This notch in the left lung exposes the lower portion of the heart and forms the upper and outer boundary of the area of the heart exposed in inspiration. The inner border of this space agrees with the median line and its lower with the lower margin of the heart.

SUBJECT II.

No. 2.—COMPOSITE PHOTOGRAPH OF CHEST AND HEART; HEART CONTRACTED.

Pericardium removed.

SUBJECT II.



No. 4.—COMPOSITE PHOTOGRAPH OF CHEST AND LUNGS IN INSPIRATION.

Pleuræ unopened.

Subject II.—Adult male; white; about 45 years of age; cause of death unknown. Subject had been injected with zinc chloride and plaster color mixture.

(A) Nipples: These are situated 3¼ inches from the median line on the extreme lower margin of the fourth rib. As the left ribs slope down slightly farther than the right, it follows that when referred to the median line the left nipple is one-fourth inch lower than the right (or the left is opposite the 5¼ I. P. and the right opposite the 5 I. P. on the M. S. L.).

(B) Heart: The auricles and aorta were injected, but the ventricles were not and were in a state of firm contraction, and so represent fairly accurately the position of the heart in systole.

(1) Base: This is indicated by a line from just above the upper margin of the third right costal cartilage, 1⅝ inches from the M. S. L. (at its 3½ I. P.), drawn across the sternum to end three-fourths of an inch to the left of the median line opposite the center of the second interspace (at the 3¼ I. P. on M. S. L.).

(2) Apex: Over the center of the seventh left costal cartilage, three-fourths of an inch from the median line (opposite its 7½ I. P.).

(3) Left border: From the left extremity of the base line nearly vertically downward to the apex point; it crosses the cartilages of the third, fourth, fifth, and sixth ribs at a distance of seven-eighths of an inch from the M. S. L. (opposite the following points on this line: Third, 3⅞ I. P.; fourth, 5 I. P.; fifth, 6 I. P.; sixth, 7 I. P.).

(4) Right border: From the right extremity of the base line downward and slightly outward to the middle of the fourth costal cartilage, 1¾ inches to the right of the M. S. L. (at its 5 I. P.). In crossing the third cartilage, it is 1⅝ inches from the same line (at its 3⅞ I. P.). The line now passes downward and inward to the center of the fifth cartilage, 1 inch from the M. S. L. (opposite the 6 I. P.).

(5) Lower border: Really continues the direction of the right border from the last point above, downward and inward in a nearly straight direction to cross the median line at its 7½ I. P. over the xipho-sternal articulation. To the left of the median line it descends a slight distance as it passes outward until about three-fourths of an inch from the same, when it turns upward to the apex and joins the lower extremity of the left border. This line is slightly concave downward and toward the right as it crosses the sixth and seventh right cartilages.

(C) Auricles.

(1) Right: Presents a pear-shaped outline in the photograph, its upper and outer margins being formed by the adjoining parts of the base and right border of the heart. Its inner boundary is indicated by a line from the base one-half inch to the right of the median line, passes vertically downward for three-fourths of an inch, then downward and outward to intersect the right border where it crosses the upper margin of the fourth costal cartilage.

(2) Left: Shows as the merest oval space in the angle of the base line and left border, and limited on the inside by a line drawn downward and outward from a point on the base one-half inch to the left of the median line to the left border at the lower margin of the third costal cartilage.

(D) Auriculo-ventricular groove: This is indicated at either extremity by the lower portions of the inner auricular margins, and its central portion by joining these two extremities by a line slightly convex upward as it crosses the M. S. L. (at its 4 I. P.) opposite the lower margins of the third costal cartilages.

(E) Coronary arteries.

(1) Right: This comes out from under the lower and middle thirds of the inner border of the right auricle nearly 1 inch to the right of the median line, and with many turns and twists, due to the contracted state of the heart, passes downward nearly vertically to the lower border of the heart.

(2) Left: This shows on the extreme left of the heart, issuing from the lower portion of the inner margin of the left auricle and descending directly to the apex, varying in its distance from the left of the median line from three-fourths of an inch in the upper third to one-half of an inch in the lower third of its course.

(F) Long axes of the heart: From a point on the base 1½ inches to the right of the median line to the apex. This crosses the middle of the sternum (opposite the 6 I. P.) on a level with the lower border of the fifth cartilages.

(G) Area of heart exposed in inspiration: Owing to the contracted state of the heart its entire lower portion to the left of the mid-sternal line and below the lower border of the fourth left cartilage is uncovered.

(H) Aorta: Right border. This is shown by a line from the right extremity of the base drawn vertically upward across the second costal cartilage 1¾ inches from the M. S. L. (at its 2¾ I. P.) then curved upward and toward the left to pass under the upper sternal fragment 1½ inches from the M. S. L. (at the 2 I. P.). The left border is covered at its beginning by the pulmonary artery and only shows as a short curved line reaching from the level of the lower margin of the second right costal cartilage one-fourth inch from the median line (at 3 I. P.) toward the left to cross the M. S. L. on a level with the upper margin of the second costal cartilages (at the 2¼ I. P.)

(I) Pulmonary artery: Occupies the interauricular space; with this width it passes upward, curving toward the left, and disappears on a level with the upper border of the second cartilages.

(J) Superior vena cava: Does not appear in the photograph.

(K) Lungs: In inspiration (moderately inflated) inclosed within the unopened pleural sacs.

(1) Right: Appears from under the upper fragment of the sternum 1 inch to the right of the M. S. L. (at its 1½ I. P.), passes downward and inward, crosses the middle line (at its 2½ I. P.) opposite the upper border of the second cartilages, continues its course to about one-fourth inch to the left of the median line, and then descends nearly parallel with the same, and at an average distance from it of one-fourth inch until opposite the upper margin of the sixth costal cartilages (at the 6½ I. P. on the M. S. L.) it bends to the right, crosses the mid-sternal line (at its 6¾ I. P.), and runs outward and downward parallel with the upper margin of the seventh costal cartilage.

(2) Left: This issues 1 inch to the left of the median line opposite the same point (1½ inch) as the right, inclines downward and inward until at the lower margin of the second costal cartilage (left) it takes a course parallel with and nearly half an inch from the (left of the) median line until just below the lower border of the fourth left cartilage (at the 5⅝ I. P. in M. S. L.), where it turns transversely outward for one-half inch, then downward and outward to the fifth intercostal space an inch from the M. S. L. (at its 6¾ I. P.). It now bends inward to meet the upper margin of the seventh costal cartilage, then turns outward along the upper margin of the same. The two lungs come in contact for only one-fourth of an inch opposite the lower margin of the third cartilage.

(3) The amount of heart uncovered by the left lung is in this case an area at the left of the median line an inch wide and nearly 2 inches long, reaching from the lower border of the fourth to that of the sixth left cartilage.

Subject III.—Adult female; white; about 25 years old; well formed and quite muscular; probable cause of death pneumonia (double). Subject was not injected. A different plan was followed in this instance from that in the two preceding cases. The subject was firmly strapped to a tilting table and suspended by the neck in a nearly vertical position. The camera was adjusted, focused, and set. Then negatives of the chest (before and after dissection), of the heart (with and without the pericardium), and of the lungs were made without disturbing the subject or camera, and these negatives fit upon each other perfectly, so that after prints were made the measurements were obtained by placing the photograph of the heart or lungs over that of the exterior of the thorax and tracing upon the latter the outlines of the former by pricking through the two with a pin. This method gives good results provided no change of focus or of the position of subject or camera is made. As the images of the deeper structures are not obscured by those of the more superficial ones, perfect outlines of the heart, with its vessels, and of the lungs can be obtained by tracing them as above shown.

(A) Nipples: The breasts were small (for a female of this size) and firm.

(1) Right: In the center of the fourth interspace 4 inches from the M. S. L. (opposite its 5¼ I. P.).

(2) Left: Over the lower margin of the fourth rib, 4 inches from the mid-sternal line (at same point as above).

The ribs on the left side curve downward slightly more than on the right, and this accounts for the different relations of the two nipples with reference to the thoracic wall. Referred to the median line they are exactly on the same level.

(B) Heart: This organ, with its vessels, was only moderately distended with blood.

(1) Base: Begins in the center of the third interspace, 1½ inches to the right of M. S. L. (at its 4 I. P.), curves slightly upward as it passes to the left to cross the median line (at its 3½ I. P.), on a level with the lower border of the third costal cartilages, and ends 1½ inches to the left of the M. S. L. (at its 3¼ I. P.) at the upper margin of the third costal cartilage.

(2) Apex: The apex point is over the interchondral articulation of the cartilages of the fifth and sixth left ribs 1½ inches from the M. S. L. (at its 7½ I. P.).

(3) Left border: Begins at the left extremity of the base line, passes downward, inclining slightly outward until the middle of the fourth interspace is reached, 2 inches from the M. S. L. (at its 6¼ I. P.). From here it turns downward and toward the right to end at the apex point. The left border crosses the third costal cartilage 1½ inches from the M. S. L. (at 3¾ I. P.), the fourth cartilage 2 inches from the same (at the 5½-inch point), and the fifth cartilage 1¾ inches (at the 6¾ I. P.).

(4) Right border: Extends from the right extremity of the base line vertically downward to the center of the sixth costal cartilage 1 inch from the M. S. L. (at its 6¼ I. P.). This border crosses the fourth and fifth cartilages at the same distance from the median line (the former opposite the 4½ and the latter the 5 ¼ I. P.).

(5) Lower border: Is indicated by a line from the lower end of the right border drawn downward and toward the left to cross the seventh right cartilage transversely to its long axis, the mid-sternal line (at its 7¼ I. P.), over the middle of the ensiform, continues still downward and toward the left to the center of the sixth left costal cartilage 1 inch from the M. S. L (at its 7½ I. P.), then curves upward to end at the apex point and connect with the lower end of the left border. This line is slightly concaved upward and to the left as it crosses the median line.

(C) Auricles.

(1) Right: The inner border is indicated by a line which starts from the base one-fourth of an inch to the left of the M. S. L., passes vertically downward until opposite the middle of the sternal ends of the fourth cartilages (at 4¼ I. P. of the M. S. L.), where it turns toward the right across the median line (at its 4⅝ I. P.), then with a slight convexity toward the right shoulder passes to meet the right border of the heart as it crosses the lower margin of the fifth costal cartilage.

The auricle is bounded on its upper and outer sides by the adjoining portions of the base and right border of the heart. In this case the auricle reaches to the left one-fourth of an inch beyond the median line.

(2). Left: This is a very small space cut off at the angle of junction of the base and left border by a line beginning seven-eighths of an inch to the left of the M. S. L. on the base line and passing downward and outward to meet the left border at the lower margin of the third costal cartilage.

(D) Auriculo-ventricular groove: Corresponds to a line joining the middle points of the inner auricular boundaries plus the lower halves of these borders.

(E) Coronary arteries.

(4) Right: Issues from the inner border of the right auricle one-half inch to the right of the M. S. L. and passes downward and inward to the lower margin of the heart at the median line.

(2) Left: This issues from the inner border of the left auricle, 1¼ inches from the mid sternal line, and passes vertically downward until near the apex, when it turns inward to reach the lower border one-half inch to the left of the median line.

(F) Long axis of the heart: From the base line three-fourths of an inch to the right of the M. S. L. to the apex point. It crosses the median line (at its 4¾ I. P.) opposite the upper border of the fifth cartilages.

(G) Area of heart exposed in inspiration was not determined, owing to the condition of the lungs in expiration—the lungs collapsed. The entire lower two-thirds of the heart to the left of the median line and below the level of the upper margin of the fourth costal cartilage is exposed.

(H) Aorta: In width as shown in the photograph about 1 inch. Its right border starts from the base 1 inch to the right of the M. S. L. and passes upward across the third cartilage seven-eighths of an inch from the median line (at the 3½ I. P.) across the second cartilage five-eighths of an inch from the central line (at the 2 I. P.), and is lost curving toward the left under the upper sternal fragment. Its left border shows only for a short distance curving over the pulmonary artery from right to left about 1 inch from and parallel with the right border.

(I) Pulmonary artery: Includes the space left between the auricles and also comes from behind the entire inner half of the left auricle. It reaches as high as the lower margin of the second costal cartilage (opposite the 2¼ I. P. on the M. S. L.).

(J) Superior vena cava: Shows in a collapsed state to the right of the aorta. Its right border reaches from the extreme right end of the base vertically upward to disappear under the upper sternal fragment and cartilage of the first rib. Its left margin is the same as the right for the aorta (in the photograph).

(K) Lungs: These could not be inflated satisfactorily (death due to a double pneumonia), so no attempt at securing photographs of them in inspiration was made.

The following measurements give the outlines of the anterior margins of the lungs in their partially collapsed state, pleuræ removed:

(1) Right: The anterior border appears above in the median line (at the 1½ I. P.), passes downward and to the left of M. S. L. until opposite the center of the second interspace (at the 2½ I. P. on the M. S. L. and one-fourth of an inch to its left), runs parallel with the median line until (opposite its 3¾ I. P.) on a level with the center of the third space, when it curves downward and toward the right and is lost running parallel with the upper margin of the sixth costal cartilage.

(2) Left: Issues from the upper sternal fragment three-eighths of an inch to the left of the M. S. L. (at the same 1½ I. P. as above), descends, almost touching the right lung, until opposite (the 3½ I. P. on the M. S. L.) the lower border of the third cartilage it turns outward toward the left along the upper margin of the fourth costal cartilage until it reaches the left border of the heart, which it follows until near the apex, then turns to the left, following the curve of the sixth costal cartilage (upper margin).

(3) Area of heart exposed in expiration (*see* § G preceding).

Comparative measurements.

(1) Base of heart:
- *a.* "Level of second costal cartilages." Quain, Gray.
- *b.* "Below level of second costal cartilages." McLachlan, Allen, Sibson.
- *c.* "Second right interspace to left first interspace." Wilson.
- *d.* Just below middle of right to above middle of left second interspaces. Haynes, Subject I.
- *e.* "Upper border of third costal cartilages." Holden, Treves.
- *f.* "Junction of third cartilage with right border of sternum." McClellan.
- *g.* "Upper margin of third right cartilage to center of second left space." Haynes, Subject II.
- *h.* "From center of third right space to upper margin third left cartilage." Haynes, Subject III (suspended vertically).

(2) Length of base:
- *a.* Not given. Quain, Gray, McClellan.
- *b.* "One-half inch to right and 1 inch to left of sternum." Holden.
- *c.* "One-half inch to right and 1½ inches to left of sternum." McLachlan.
- *d.* "One inch to right and 2½ inches to left of sternum." Wilson.
- *e.* Haynes—
  - Subject I, 1¼ inches to right and 1½ inches to left of median line = 2¾ inches.
  - Subject II, 1⅝ inches and ¾ inch, respectively, = 2⅜ inches.
  - Subject III, 1⅛ inches and 1⅜ inches, respectively, = 2½ inches.

(3) Apex point:
- *a.* "In fifth left interspace 3½ inches from median line." Quain, Gray, McLachlan, McClellan.
- *b.* With reference to left nipple, "1½ inches below and three-fourths inch to inside," Quain, Gray; "2 inches below and 1 inch to inside, Holden;" "2 inches below and one-half inch to inside," Wilson.
- *c.* "Fifth left interspace at costo-chondral articulation," Treves.
- *d.* Haynes:

Subject I. Fifth left space 2¼ inches from M. S. L. (at its 7 I. P.).

Subject II. Behind center seventh left cartilage three-fourths inch from M. S. L. (at its 7 I. P.). Heart in I distended, in II contracted.

Subject III. Behind interchondral articulation between fifth and sixth cartilages 1½ inches from M. S. L. (at its 7½ I. P.). Subject suspended, heart moderately distended with blood.

(4) Right border: The farthest point reached from the mid-sternal line. Quain says 1½ inches. None of the other writers I consulted mentioned it.

Haynes—Subject I, 1¾ inches over fourth cartilage; subject II, 1¾ inches over fourth cartilage; subject III, 1 inch over fourth cartilage.

(5) Left border: Farthest point reached from the mid-sternal line. None of the above writers referred to it.

Haynes—
- Subject I. Heart distended "in diastole," 2⅞ inches over the center of the fourth interspace.
- Subject II. Heart contracted "in systole," seven-eighths inch over center of fifth cartilage.
- Subject III. Midway between "systole" and "diastole," 2 inches over fourth interspace.

(6) Lower border: The point at which it crosses the sternum.
- *a.* "Bottom of sternum," Holden.
- *b.* "Xipho-sternal articulation," McLachlan.
- *c.* "Upper third of ensiform," Quain.
- *d.* Haynes—
  - Subject I. Middle of ensiform.
  - Subject II. Xipho-sternal articulation.
  - Subject III. Middle of ensiform.

(7) Area of cardiac dullness in inspiration.
- *a.* Quain: "Two lines from point of apex beat to the middle line of the sternum; one horizontal, the other obliquely upward to between the fourth cartilages.
- *b.* Gray quotes from Holden.
- *c.* Holden quotes from Latham: "Make a circle 2 inches in diameter round a point midway between the nipple and end of the sternum."
- *d.* Treves quotes from Latham.
- *e.* McClellan: "Line from middle of the sternum opposite fourth left costal cartilage to the point of junction of the left fifth rib and its cartilage, and from this point horizontally back to sternum."

(7) Area of cardiac dullness in inspiration—Continued.

f. Haynes—

Subject I. A quadrilateral space bounded on right by median line, below by lower border of heart; above by a line from middle of fourth cartilages along upper margin of fifth left cartilage to 1¼ inches from median line; on left by a line from last point downward to intersect the lower border of the heart three-fourths of an inch from the left of the median line.

Subject II. Heart contracted. All of the heart to the left of the median line and below the lower margin of the fourth left cartilage.

Subject III. Lungs (in expiration) collapsed. Entire lower two-thirds of heart to left of median line and below the upper margin of the fourth left cartilage.

(8) Auricles:

a. Quain: "The right auricle lies behind the sternal ends of the third, fourth, and fifth cartilages, and the intervening portions of the intercostal spaces, and is also partially covered by the right edge of the sternum. The point of its auricular appendage is exactly behind the middle line on a level with the upper border of the third costal cartilage. The left auricle extends vertically from the level of the lower border of the second left cartilage to the upper border of the fourth (sternal end). The apex of its appendage is in the lower part of the second intercostal space, or behind the third costal cartilage, about 1¼ inches from the left of the sternum."

b. Haynes—

Subject I. Right: The outline in the photograph is markedly "ear-shaped." It is behind the first inch of the third right costal cartilage with the adjacent border of the sternum and the third space. Left: Oval outline one-half inch by 1 inch placed over a portion of the second space and third cartilage. The center of the area being 1¼ inches from the left of the median line and its long axis extending from above downward and toward the left.

Subject II. Right: Pear-shaped outline, base uppermost covers first inch from sternum of third right cartilage and space. Left: Behind the chondro-sternal articulation of the third left cartilage; oval shaped; long axis as in No. I.

Subject III. Right: Distinctly auricular shaped. Includes fourth and fifth right cartilages for 1 inch from sternum and the included space, with the right half of sternum opposite the fourth chondro-sternal articulation. Left: Behind the third left cartilage, its center 1¼ inches from the median line, its long axis inclined as in No. I, and the shape the same.

(9). Auriculo-ventricular groove—

a. Quain: "The auriculo-ventricular sulcus corresponds with a line drawn obliquely upward from near the sternal end of the sixth costal cartilage on the right side to the third cartilage on the left."

b. Haynes—

Subject I. (Approximately stated.) A curved line, with the convexity upward from the upper margin of the fourth right cartilage, 1¾ inches from the median line to the middle of the third left cartilage, 1¾ inches from the middle line. This line crosses the center of the sternum on a level with the lower border of the third cartilages.

Subject II. This line takes the same course as in No. I, except it ends at the lower margin of the third left cartilage, seven-eighths of an inch from the median line.

Subject III. (Suspended.) A line convex upward from the upper margin of the sixth right costal cartilage, 1 inch from the median line to the lower border of the third left cartilage, 1⅛ inches from the central line. The sternum is crossed on a level with the lower border of the fourth cartilages.

(10) Aorta (first portion):

a. Commences "behind the sternum, on a level with the lower border of the third costal cartilage on the left side, and rises as high as the upper border of the second costal cartilage of the right side. Its length is about 2 or 2¼ inches." Quain.

b. "Commences on a level with the lower border of the third costal cartilage behind the center of the sternum; passes obliquely upward to the right side as high as the upper border of the second right costal cartilage. It is about 2 inches long." Gray.

c. "Its origin is on the left side of the middle of the sternum, about on a level with the lower border of the third costal cartilage, ascends with a slight curve, the convexity looking forward and to the right side as far as the upper border of the second costal cartilage of the right side. It is about 2 inches in length." Holden.

(10) Aorta (first portion)—Continued.

d. "The aortic opening is behind the left border of the sternum close to the lower edge of the third cartilage. The trunk ascends behind the second cartilage of the right side." Treves.

e. Haynes—

Subject I. Its axis corresponds to the median line. It is about an inch wide and reaches from the upper border of the third cartilages to the middle of the cartilage of the first rib. It is about 2 inches long.

Subject II. The aorta reaches from the upper border of the third right cartilage to the upper margin of the first cartilage. It is entirely to the right of the median line for the first two-thirds of its course and only curves toward the left after reaching the upper margin of the second cartilage. Same length as in Subject I.

Subject III. (Suspended, not injected.) Reaches from the upper level of the fourth cartilages at their sternal junction, entirely to the right of the median line upward to the lower level of the first cartilage, where its center is behind the mid-sternal line.

(11) Pulmonary artery:

a. Quain: "The pulmonary orifice is placed opposite the upper margin of the third left costal cartilage, close to the sternum. The artery proceeds upward to its bifurcation behind the second costal cartilage. It is nearly 2 inches long."

b. Treves: Essentially same as Quain.

c. Gray, Holden: Do not give its surface relations.

d. Haynes—

Subject I. Begins on a level with the lower border of the third cartilages; its center being half an inch to the left of the middle line. It proceeds upward and toward the left and terminates just above the lower margin of the second left cartilage; here its center is about three-fourths of an inch to the left of the median line. The artery is a little over an inch wide and 1½ inches long.

Subject II. Begins on a level with the lower margin of the third cartilages; its center behind the median line proceeds upward, inclining a little to the left, and ends on a level with the upper border of the second cartilages, its center being one-fourth of an inch to the left of the median line. It is about 1 inch wide and 1½ inches long.

Subject III. Begins on a level with the lower margin of the third left cartilage entirely to the left of the middle line, being about 1¼ inches wide, passes upward until opposite the middle of the second left cartilage, where the center of the vessel is three-fourths of an inch from the left of the median line. It is a little over an inch wide at its beginning and about 1½ inches long.

(12) Coronary arteries. Haynes:

Subject I. (Heart distended.) They run nearly vertical and parallel with the median line, the right 1 inch and the left 1⅜ inches from the same; the former from the lower border of the third right cartilage, and the latter from the middle of the third left cartilage, and each extends to the lower level of the sixth cartilage.

Subject II. (Heart contracted.) Right artery is at an average distance of seven-eighths of an inch from M. S. L., parallel with same (nearly), and extends from upper border of fourth to upper border of sixth cartilage. Left is parallel with central line and three-fourths of an inch from it, and reaches from lower level of third cartilage to apex.

Subject III. (Heart moderately distended.) Right: From upper border of fifth cartilage close to sternum to middle of ensiform. Left: From lower margin of third cartilage 1 inch to left and parallel with median line toward apex.

(13) Anterior margin of the lungs and the extent of their contact during inspiration.

a. Quain: "Meet at junction of manubrium and body of sternum, descend together, right sometimes projecting a little to left of middle line, as far as the fourth costal cartilage; right lung continues straight course to sixth costo-chondral articulation; left slopes outward behind fifth costal cartilage, indicated by a line from fourth left chondro-sternal articulation to apex point."

b. Gray. Holden: "Anterior border of right lung corresponds to median line from junction of first and second pieces of sternum as low as sixth costal cartilage; anterior border of left lung lies in the middle line only as far as the fourth costal cartilage."

(13) Anterior margin of the lungs and the extent of their contact during inspiration—Continued.

c. Treves: "Meet in middle line at junction of manubrium and gladiolus; right continues vertically downward behind middle line to sixth chondro-sternal articulation; left keeps close to right to fourth chondro-sternal articulation, when it turns off, following a line from fourth cartilage to apex of heart."

d. Haynes—

Subject I. Converge from apices and meet at level of upper border of second cartilages one-fourth inch to left of median line and run parallel with same to level of the upper border of fourth cartilages. The right lung continues at the left of the middle line until at the upper margin of the sixth chondro-sternal articulation, when it crosses to the right. The left turns outward along the upper margin of the fifth cartilage. Length of contact, nearly 3 inches.

Subject II. Anterior of right lung crosses to the left of the middle line on a level with the upper border of second cartilages and continues straight down to lower level of sixth costal cartilages at sternum. The left nearly meets the right at lower level of second left costal cartilage, continues nearly in contact (and opposite third space in actual contact) to level of upper border of fifth left cartilage at sternum, along which it passes outward and toward the left.

(14) Points on the mid-sternal line opposite the centers of the sternal ends of the costal cartilages:

Number of cartilage.	Subject I. (Male.)	Subject II. (Male.)	Subject III. (Female.)
	Inches.	*Inches.*	*Inches.*
First	1⅓	1¾	1
Second	2⅓	2⅝	2
Third	3⅓	3¾	3¼
Fourth	4½	5	4¼
Fifth	5¼	5¾	5
Sixth	6	6½	5⅞
Seventh	6½	7	6⅜

DISTANCES BETWEEN THE CARTILAGES.

Between first and second	⅝	⅞	1
Between second and third	1⅜	1⅓	1¼
Between third and fourth	1	1¼	1
Between fourth and fifth	¾	¾	¾
Between fifth and sixth	¾	¾	⅞
Between sixth and seventh	½	½	½

(15) Relative position of nipples. All the authorities agree in placing them in the fourth interspace, three-fourths of an inch external to the junction of the ribs and cartilages, or rather more than 4 inches from the median line.

In the two male subjects (I and II), the nipples were over the lower half of the fourth ribs, 3½ inches from the median line. In the female (Subject III), they were 4 inches from the median line, the right in the center of the fourth interspace and the left over the lower margin of the fourth rib. In the males the measurements were made upon the thorax after removal of the superficial tissues; in the female upon the exterior of the chest before such dissection.

From a comparison of the preceding quotations and the original measurements we see that at many critical points there is a wide difference between the accepted relations given in the text-books and those revealed by composite photography.

As regards the lungs, these differences are so small as to be of little importance, but in reference to the heart are so pronounced as to make us wonder if the currently stated relations of heart and chest do not need revision. For example, is it not possible, nay, more than probable, that the authorities, in placing the apex beat

3½ inches to the left of the median line, have not gone at least an inch over the mark? For the apex point in Subject I, where the heart is fully distended, is only 2¼ inches from the median line.

Neither can it be said in explanation of this difference that the heart has been moved bodily toward the right. It has not we can see, for its right border only reaches 1¾ inches from the middle line. Nor can it be claimed that the heart has been foreshortened by the camera at the expense of the chest, for the heart in the photograph is nearly 5 inches wide. Besides, this error of foreshortening is prevented by measuring the distances upon the bony framework of the chest itself before taking the photographs, and any foreshortening of the heart is compensated for by the same occurrence in the image of the chest, and the results are unimpaired. Moreover, the heart has not received complete treatment by the authorities quoted, in that its auricles, borders, and its great vessels have not been traced in sufficient detail upon the bony framework of the chest. This is due no doubt to the uncertainties of the methods used for ascertaining these relations. In these composite photographs the relations lost by the former method are brought out with remarkable clearness and can be readily traced, and their details have been given in the preceding pages, too full to produce attractive reading, but not, I hope, for accurate reference.

In concluding this paper I offer the following summary of the external relations of the viscera in question. These results comprehend the conclusions derived from the statements of the authors consulted and from my own observations.

CONCLUSIONS.

(1) Base of heart: A line crossing the sternum obliquely from the upper margin of the third right to the lower border of the second left costal cartilage, 1½ inches from the median line on each side.

(2) Apex: In the fifth space, near the upper margin of the sixth costal cartilage, 2¼ inches to the left of the median line.

(3) Right border: From the right end of base curved slightly outward to reach a point 1¾ inches from right of middle line over the fourth cartilage and end at the center of the fifth cartilage, 1 inch from the mid-sternal line.

(4) Left border: From the left end of base, with a convexity outward, to the apex. It reaches its greatest distance of 3 inches from the sternal center over the fourth space.

(5) Lower border: A line curved downward at its beginning (at lower extremity of right border) and ending (at the apex), and slightly convex upward in its center as it crosses the middle of the ensiform.

(6) Heart dullness: A quadrilateral area to left of median line and below the upper border of the fifth cartilage, nearly 2 inches in vertical and 1½ in extreme lateral measurements.

(7) Auricles: Right "ear-shaped" (facing to left), covering the first inch of the third right space and cartilage with the portion of the sternum adjacent to the latter. Its long axis measures about 2 inches and is inclined from above downward and outward. Left, is a small oval space ½ by 1 inch (its center 1¼ inches to left of median line) behind the second left space and third cartilage. Its long axis directed from above downward and outward.

(8) Auriculo-ventricular groove: Is indicated by a line from the right to the left heart borders, beginning on a level with the upper margin of the fourth right, and ending on a level with the lower edge of the third left cartilage. This line is convex upward and crosses the middle of the sternum on a level with the lower border of the third cartilage.

(9) Aorta: A little more than an inch wide and 2 inches long. Extends from the upper border of the third to behind the middle of the first cartilages. At its beginning and ending its center is behind the median line, but in the middle of its course the artery is convex toward the right.

(10) Pulmonary artery: About 1¼ inches wide and 1½ inches long (in the photograph). Begins on a level with the lower border of the third and ends behind the middle of the second left cartilages. Below, its center is one-half inch and above, three-fourths of an inch to the left of the median line.

(11) Coronary arteries: Both are nearly vertical (incline slightly toward the median line at their lower ends). Right, 1 inch from mid-sternal line. Extends from the upper border of fourth to lower of sixth cartilages. Left, 1⅝ inches from middle line in expansion and three-fourths inch in contraction. Extends from middle of third to lower border of sixth cartilages.

(12) The anterior margins of the lungs in inspiration: Right, lies to left of median line, one-fourth inch from and parallel with it from the upper margin of second to that of sixth cartilages (sternal ends). The left is in contact with the right from the upper border of the second to the midpoint between the fourth cartilages, where it turns downward and outward along the upper margin of the fifth left cartilage. Length of contact, 2½ inches.

(13) The centers of the sternal ends of the costal cartilages are opposite the following distances on the mid-sternal line measured from the supra-sternal notch.

Cartilages.	(a) Male (average of 2). Distances from each other.		(b) Female. Distances from each other.	
No. 1	1⅝	.....	1	.....
No. 2	2¾	¾	2	1
No. 3	3⅝	1¼	3¼	1¼
No. 4	4¾	1⅛	4¼	1
No. 5	5½	¾	5	¾
No. 6	6¼	¾	5⅞	⅞
No. 7	6¾	½	6⅜	½

(14) Nipples: Over the lower margin of the fourth ribs, 4 inches from the middle line.

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5. Treves Applied Anatomy.
6. McLachlan's Applied Anatomy, third edition, Vol. II.
7. Wilson's Vade Mecum, 1892.
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10. Morton's Human Anatomy.
11. Cruveilhier, Pattison's Translation.

SECTION X.—PHYSIOLOGY.

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Dr. Ramón Porra Picón, Merida, Venezuela.

ADDRESS BY THE PRESIDENT, ISAAC OTT, M. D., OF EASTON, PA.

Gentlemen: In opening the physological section of the Pan-American Congress, I have the great pleasure to extend to the medical representatives from the Americas, North and South, as well as the United States, a most cordial welcome. I hope that all our friends will do us the great honor of being present at our meetings, and that they will enter into the discussion of papers which will be presented. You are invited to take a deep interest in the proceedings, as many subjects of importance to scientific and practical medicine will be considered. As this is our first meeting as Pan-Americans, let us make it one of fruition and value to humanity. It is my pleasant duty to announce to you that during our sessions we shall be honored with representatives from other countries, and it is very agreeable to first mention the name of Prof. Johannes Gad, most worthy representative of the University of

Berlin and the Centralblatt für Physiologie. I have next to announce the name of Prof. A. B. MacAllum, of Toronto University, who represents most excellently Canadian physiology. With regard to the subject of to-day, I shall only speak of American physiology as far it relates to the United States. I restrict myself to this plan, as I am not sufficiently acquainted with the literature of either North or South America to treat it with any precision.

Before taking up the subject of physiology in detail, it might be well to note the state of physiology abroad at the beginning of this century, for the influence of French physiologists was great up to 1870, since which time we have been greatly reacted upon by the physiologists of Germany, and, to a certain extent, by the French. As we all know, the immortal Haller died in 1777. In France, at this period, Lavoisier published his experiments upon the respiration of animals, and in 1780, in conjunction with La Place, his great memoir upon animal heat. About the year 1800, the French physiologists were Petit at Namur, Housset, Le-Gallois, and Bichat. In England, in 1811, Charles Bell published his epoch-making memoir on "A New Anatomy of the Brain," at the age of 26. In Germany, Fiedemann and Bendach were the chief exponents of physiological progress. But at the end of the first quarter of this century the mighty influence of Magendie was felt by the introduction of the experimental method in physiology.

In the study of the physiological papers of the United States I shall only take notice of articles containing some original observations, and waste no time on theoretical lucubrations. "*Hablen cartas y callen barbas.*" Further, I shall not pretend to make this review exhaustive, as neither the time nor the libraries are sufficiently accessible to me, yet I shall try not to miss the main papers.

In 1795 Samuel Latham Mitchill, a professor of chemistry in the College of New York, made the observation * that pulsations of the heart can be accelerated or retarded by the varied state of the respiration. In the year 1800 I find a thesis presented to the University of Pennsylvania by Dr. John Baptiste Clement Rousseau, of Hispaniola. It was upon the subject of absorption, and, singularly to state, the first third of this century is mainly devoted by our writers to this subject. I can only account for it by the fact that the great external use of mercurial ointment in practice led our professional brethren to theorize upon its action and finally to experimentally determine the truth or falsity of their hypotheses. He held that no absorption could take place from the skin unless the cuticle was destroyed by friction, although the cuticular injury might not be apparent to the eye. He states that it never has been decidedly proved that mercury was received and carried into the system by absorbents, for he found no mercury in the urine, milk, or other fluids of animals to whose surface mercury was freely applied. He is not able to positively say, but he states it seems probable, that mercury is volatilized by friction and is absorbed in fine particles like musk and spirits of turpentine. In his first experiment he swallowed, at 10 A. M., a few drops of spirits of turpentine with sugar, water, and sweet spirits of nitre. He soon found a violet odor in the urine. In his second experiment he exposed some turpentine in an open bowl in a close room at the temperature of 61° F. In half an hour he found his urine with an odor of violets. In his third experiment he breathed through a tube opening outside the room, and closed his nose, then exposed turpentine in the room, but no violet odor was perceived in the renal secretion. In the fourth experiment he immersed his hand and wrist in turpentine and breathed through the tube outside the room with nostrils closed, but no violet odor was perceived. In fifth experiment, still breathing through a tube outside room, nostrils closed, then smeared body with turpentine by means of a sponge, but no odor to urine. In experiments, 6, 7, and 8, found inhalation of fumes of turpentine from a bottle sufficient in half an hour to be perceived in the urine. His conclusions were: (1) Absorption is performed by the lungs; (2) absorption is performed by the lungs alone; (3) no substance can be introduced by the skin when the cuticle is sound and entire.

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*On Gaseous Oxide of Azote, New York, 1795, 12 mo., p. 12.

In the same year (1800) a thesis of the University of Pennsylvania was published by Dr. James Agnew, of New Jersey, upon the perspiration.* In 1805 Dr. Dangerfield repeated Rousseau's experiments. He also put large plasters of mercurial ointment to the calves of the legs, bandaged them fast, and covered the whole with a stocking. He wore these eight days, but no ptyalism ensued. He then restricted his diet, bled himself 20 ounces, and then left the plasters on for seven to eight days, but no salivation ensued. In other experiments he applied less mercurial ointment, but with friction, and in three days ptyalism ensued. In another experiment he applied mercurial ointment to upper surface of each foot and wore oilcloth stockings for ten days, without effect. He concludes that substances are not carried to the circulation from sound or abraded skin, but he does not conclude that there are no absorbents beneath the skin.

In 1806 Dr. Reuben D. Mussey, of Massachusetts, published some experiments on cutaneous absorption.† He states that doubts as to the absorption by the skin were first raised by Mr. Segum, of Paris, and by the experiments of Drs. Rousseau, Dangerfield, and Klapp. Although he alludes to Dr. Klapp's experiments, I can not find any publication of the same before 1811. Since colored substances, as madder, are absorbed by the intestinal canal unchanged, he started some experiments with it. In his first two experiments he immersed himself in a bath of strong watery infusion of madder. He found his urine tinged red in three to five hours and when treated with Fe SO_4 gave a purplish brown color. In another experiment he was bled three and five hours after the bath, but the blood serum appeared the same. From these experiments he concluded that madder entered the system by cutaneous absorption, and not by the lungs.

In 1809 Dr. J. Redman Coxe‡ published a paper supporting the doctrine of cuticular absorption, but he made no experiments.

In 1811 Dr. Joseph Klapp§ published a paper upon absorption, criticising Dr. Mussey's experiments. He probably was the first man in the United States to make a vivisection. In a dog the trachea was tied off, when a tube from a bottle of turpentine was introduced into the trachea below the ligature. The dog inhaled the turpentine for two hours, when the tube and ligature were removed from the trachea. The urine collected had a strong violet odor. After quoting Dr. Dangerfield's experiments, he arrives at the conclusion that the mercury is volatilized and inhaled by the lungs. To support this view, he had his servant rub mercurial ointment on the inside of the doctor's leg an hour at a time, twice daily, for six days. Dr. Klapp breathed pure air from out of doors by means of tube through a window. At the end of six days he had not the slightest salivation, but the servant was badly ptyalized, so that the experiment was arrested, although the servant wore gloves during the frictions. In this paper he alludes to Dr. Darwin's theory of a supposed occasional conveyance of fluids from the stomach to bladder by supposed inverted motion of urinary lymphatics. To disprove this, Drs. Klapp and Rogers performed the following experiment: Opened the abdomen of a dog; both ureters were tied off above the bladder; urine passed out of bladder; his penis ligated. Dog was then given gin, madder, and nitre for an hour or two. At the end of eleven hours the bladder was found empty. Drs. Smith and Rousseau,‖ in 1811, made some experiments upon cuticular absorption. They found, as Mussey, that madder is absorbed by the skin and colors the urine. They found the same to be true of rhubarb. They also state that no astringents, narcotics, or coloring substances have the slightest effect if the nostrils are stopped.

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* Thesis University of Pennsylvania.

† Philadelphia Medical and Physical Journal.

‡ Philadelphia Medical Museum, vi, 55.

§ Philadelphia Medical Museum, vi, 83.

‖ Philadelphia Medical Museum, 1811.

From 1811 to 1821 there is no record of any physiological papers. In 1821 Drs. Richard Harlan, J. B. Lawrence, and B. N. Coats,* a committee of the Academy of Medicine of Philadelphia, made a report on the means by which absorption is effected. William and John Hunter thought Hippocrates and Galen in error in stating that absorption took place by the veins. The Hunters proved that it was accomplished by the lymphatics. Magendie, about this period, believed it took place by the veins, which was confirmed by Harlan, Lawrence, and Coats. They showed the error of Hunters' experiments. These gentlemen used forty-three animals. Their conclusions were that the coloring matters were not absorbed by the lacteals in the living body. Prussiate of potash enters by the lacteals and thoracic duct. If you mix nux vomica and prussic acid you destroy life by an action upon the nerves. Contrary to the assertion of Magendie, ink will not infiltrate the living body. When it was placed in the intestine, peritoneal, and pleural cavities it was not absorbed. The odors of camphor, mint, and asafetida infiltrate through the intestine.

The chemical and odorous substances above mentioned are absorbed from the stomach slower than from the intestine, and from the peritoneal cavity even slower and with more difficulty. They showed that absorption does not come from the arteries exclusively. They bled animals to death, tied their aortæ, and then injected saline fluid into the peritoneal cavity and found that some disappeared. In 1822 Dr. John Hubbard† made some experiments upon absorption. He tried to prove that absorption took place by the lymphatics, and not through the walls of the veins and arteries. He exposed in a number of animals the arteries and veins, and placed lead plates on cards underneath the vessel so that the wall of the vessel could be bathed by the solutions without the solutions touching the wound. He then applied prussic acid and nux vomica to the walls of the vessels for twenty to thirty minutes, and they had no effect. Later he placed these drugs in the wound and they were promptly absorbed and produced characteristic effects. He also made control experiments to show that the nux vomica and prussic acid were good preparations.

In the same year Dr. Robert Melnor‡ published a paper on the absorption of active medicine into the circulation, and also the effects of nutritive enemata. He first shows the physiological action of gamboge and tartar emetic when injected directly into the jugulars of cats and dogs. He then injected asafetida into the veins, and found its odor in the blood for some time. He injected milk into the jugular vein in three instances without producing death, showing that nutritive fluids can be directly thrown into the circulation with impunity. He fed a dog upon garlic in meat; afterwards he killed the animal and found the whole body saturated with the odor. The blood gave off the odor of garlic after the animal had been fed on it for a few days. He fed a dog on indigo and found the color in the lacteals. He fed a dog on rhubarb, killed him in one hour and a half, and found rhubarb in the bile. He injected madder into the blood and found it in the bones. He fed several cats on enemata of milk, mutton, and chicken broth, and found slight alteration in weight. This demonstrated that they could readily take nutriment per anum, and that sufficient was absorbed to sustain life. In 1825 Dr. Beaumont began his celebrated researches upon Alexis St. Martin, showing effects of the gastric juice upon the foods.

In 1827 Dr. Togno‡ made a series of experiments upon endosmosis and exosmosis. His experiments were confirmatory of Mr. Dutrochet. The experiments were made with the intestines and crops of fowls, as well as with the skin of a rat. The fluids used were gum-arabic solution, water, weak acid, and alkaline solution. He proved that endosmosis occurs in a certain membrane as long as its composition is normal. When it becomes putrid, exosmosis takes place very rapidly. He showed that endosmosis and exosmosis can go on at the same time. The denser of two liquids induces

* Philadelphia Medical and Physical Sciences, 1821.

† Philadelphia Journal of Medical and Physical Science, Vol. IV.

‡ American Medical Journal, 1827.

the rarer to form a current toward the former. By inverting the experiment he found the same thing would take place the other way through animal membranes.

In 1827 Dr. James Moultrie, Jr.,* published a paper upon the use of the lymph. He concludes that lymph is not a residuary fluid transmitted from arteries to veins nor decomposed matter of tissue which it is the office of absorbents to remove. The origin, nature, and destination of lymph render it probable that it is a special secretion. Its office is to vivify the chyle, to augment the animalization of arterial blood, and, lastly, to produce all those effects which constitute the phenomena of reproduction, adhesion, etc. The lymphatics, according to him, are not the absorbents of the body.

In 1830 Dr. Edwin D. Faust,† of Columbia, S. C., made a series of experiments and observations on endosmosis and exosmosis of gases and the relation of these phenomena with the functions of respiration. He reviews the work done on the interchange of gases through animal membranes. He makes some experiments with endosmometer, using nitrogen, hydrogen, carbonic acid, and air. When gases are separated by a membrane, both of them pass through partitions, but one or other predominates. He then applies interchange of gases to respiration, showing there is a chemical combination.

In 1830 Dr. Samuel Jackson‡ published a paper upon the pulse and its modification. He shows that the frequency, force, and rhythm of pulse depend upon the heart; the volume of the pulse on the condition of the capillaries. The condition of the arteries modifies the tension of the pulse.

In 1830 Dr. J. K. Mitchell§ published a paper on the penetrativeness of fluids. After showing how gases penetrate membranes of gum elastic and also animal membranes, he made experiments with sulphuretted hydrogen, carbonic acid, nitrogen, and hydrogen. He shows very clearly that they penetrate the membranes of the body. He injects acetate of lead into the peritoneal cavity, and the sulphuretted hydrogen into the rectum. The animal dies and he finds a precipitate over the intestine. He then tries the interchange of different fluids, alcohol, ether, acid, and alkali water, etc., through different animal membranes, gum elastic, bladder, and human skin. He shows very well the penetrativeness of gases in organic tissue. The ratio of penetration for gases depends on them alone, while for liquids it depends on both the liquids and tissues.

In 1831 Dr. William V. Volk,‖ of Providence, R. I., published a paper upon microscopical observation on portions of animal tissue, with additional experiments on endosmosis and exosmosis. His results were not in harmony with those of Dr. Togno. He ran his experiments for several days with crop and intestines of a fowl. He found endosmosis in intestines, and exosmosis in crop and cæcum. It is probable that the decomposition of his membranes caused his disagreement with the results of Dr. Togno.

In 1833 Dr. Maurice Fitz Gibbon¶ published a paper on the forces by which the blood circulates. He dissected several hearts to determine the arrangement of the muscular fibers.

In 1834 Dr. Samuel Jackson,‖ of Philadelphia, published a review of the subject of absorption, with some experiments. The paper is a very lengthy and exhaustive one, and I shall only speak of a few points in it. According to him the skin absorbs, as do the lungs, stomach, cellular, and serous tissues. He speaks of Dr. J. K. Mitchell injecting into the pleural cavity solution sulphate of iron and prussiate of potash into the peritoneal cavity. He saw a blue color in the veins of diaphragm. He also speaks of vascular absorption, the part of absorption in nutrition, and the mechanism of absorption. Dr. Jackson exposed and ligated the external jugular vein in two places, applied prussiate of potash to wall of vein and obtained a blue

* American Medical Journal, 1827.
† American Medical Journal, Vol. VII, p. 23.
‡ American Medical Journal, May, 1830.
§ American Medical Journal, Vol. VII.
‖ American Medical Journal.
¶ American Medical Journal, 1833.

color on treating lining of vein or serum with sulphate of iron. According to him they proved that lymphatics were not exclusively the only means of absorption. He states that dropsy is caused by defective absorption, that it is a vice of nutrition and impoverished state of the blood.

In 1836 Dr. J. K. Mitchell * published a paper on penetration of gases. He repeats many experiments in a paper just noticed and shows that the laws of diffusion established by Mr. Graham, of Glasgow, do not apply to animal membranes of a closer structure than stucco.

In 1836 Dr. Robert E. Rogers,† of Philadelphia, published some experiments upon the blood. He found that exhaustion by his air pump had no effect on evolving CO_2. A temperature of 212° F. does not displace carbonic acid. Carbonic acid is absorbed by exposing venous blood. The exposure of venous blood to oxygen, nitrogen, hydrogen, and nitrous oxide does not displace carbonic acid, although some of each gas (except hydrogen) is absorbed. When venous blood is put in a bag with access to an atmosphere of oxygen, hydrogen, etc., then more carbonic acid is given off.

In 1838‡ Dr. John D. Fisher, of Boston, published a paper upon the cerebellum, showing a loss of sexual sense.

In 1838§ Dr. John W. Draper published a paper on some mechanical functions, the coördination of the diffusion laws, by Professor Graham, and the experiments of Dr. J. K. Mitchell. This paper deals with diffusion of gases, and shows that peculiar mechanical functions depend on the condition of texture. They often, in appearance, are the generators of power. Endosmosis is a manifestation of capillary attraction and does not bear any peculiar relation to organization. There is no case on record where endosmosis has effected a real chemical change.

In 1839 Dr. J. J. Allison‖ published experiments proving the existence of a venous pulse, independent of heart and nervous system, with remarks on contractility of veins in general. He made experiments upon animals, and noted that the venæ cavæ and pulmonary veins pulsate in four classes of vertebrates. Distension by blood is not necessary for their contraction. In 1839 Drs. C. W. Pennock and Moore ¶ published a paper upon the heart's action. Their experiments were made upon sixteen calves and sheep, Drs. Hardy, Stillé, George B. Wood, and Mr. Burns being present. The animals were knocked on the head with an axe. Artificial respiration being kept up by a bellows, the chest opened longitudinally, the heart observed and its sounds listened to by another member with a stethoscope. They determined that the impulse was synchronous with the ventricular contraction caused by apex striking chest wall. The blood is expelled from the ventricles by approximation of walls and not by contraction of apex toward base. During systole the heart performs spiral movements and becomes elongated. The ventricle contracts and the auricle dilates at the same time, occupying one-half the whole cycle of time. Diastole immediately follows systole, equal to one fourth of cycle, the auricle diminishing by emptying blood into ventricles without muscular contraction. The remaining one-fourth is devoted to rest, near the termination of which the auricle contracts actively. The sounds of the heart are produced by motions of heart on its contents and not by striking against chest wall. Sounds were much louder when stethoscope directly applied to heart than when chest wall or lung is interposed. The sounds are more distinct when muscle is thin and contracts quickly. Hence clear flapping sound over right ventricle as compared with left. First sound impulse and ventricular systole are synchronous. Muscular contraction is the chief factor in its production, for it is heard in extirpated heart with auriculo-ventricular valves held up. Contraction of auricle, flapping of auriculo-ventricular valves, and rushing of blood may contribute to it. The second sound

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*American Medical Journal, 1836, p. 100.
†American Medical Journal, 1836, p. 277.
‡American Medical Journal, 1840.
§American Medical Journal, 1838.
‖American Medical Journal.
¶Medical Examiner, 1839.

exclusively due to closure of the semilunar valves. The second sound is synchronous with diastole of ventricle. In 1839* Prof. Joseph Henry was the first to graduate electrical currents by sliding the secondary coil in a groove to and from the primary, as is done in Du Bois-Reymond's inductorium.

In 1840 the medical faculty† of Lancaster, Pa., made some experiments upon the body of an executed criminal. Drs. John and Washington Atlee were among the observers; also Dr. J. K. Mitchell. They found that when the air taken from the lungs before and after execution was analyzed that the CO_2 increased and the oxygen diminished after the execution. In 1842 Dr. C. A. Lee‡ published a monograph on the thymus gland. Under the microscope the gland was seen to contain an enormous number of white blood corpuscles, and he believed its function to be closely connected with hæmatosis and chylification.

In 1842 Dr. Blanchard Dogati§ reported a case of a girl, *æt.* 16, having passed puberty, who went into a deep sleep, or "catalepsy," as he calls it, when acted upon by a magnetizer for fifteen minutes.

In 1847 Dr. Samuel Kneeland,§ of Boston, published an article upon the use of cold water for the prevention and cure of disease. He speaks of the use of cold baths in fevers and hydrotherapy in general.

In 1847 Dr. C. W. Pennock§ published a paper upon the frequency of the pulse and respiration of the aged. He made his observations in the Philadelphia Hospital. He excluded all cases with cardiac, pulmonary, or other disease. The observations were made four hours after meals, with the patient sitting or standing. He examined 170 men, ages from 50 to 90 years, and 203 women, ages from 50 to 115 years. The average age of the men was 64.09 years. Their average pulse was 71.83; average respiration, 20.51; ratio 1:3.5. The average age of the women was 70.57 years; their average pulse, 78.02; their average respiration 22.06; ratio 1:3.50. He concludes in this very valuable and scientific paper that the frequency of the pulse of the aged is greater than usually admitted. The respiration frequency of old age is equal to that of the adult middle age.

In 1849–'50 Dr. Bennet Dowler‖ made some contributions to physiology. He cut the spinal cord of alligators and found movements in the head and in the parts behind the section. The head tried to bite when one came near it, and it winked. He argues that this was not reflex, because there was no contact. According to him the spinal cord movements were from memory and not reflex. Evisceration does not kill the alligator, the heart beating for hours. Ligature of the trachea kills this animal quicker than section of the spinal cord.

In 1848 Dr. Charles Frick,¶ of Baltimore, published his paper upon the blood, its amount of fibrin in different diseases.

In 1848 Dr. George Wymberly Jones, of Georgia, made an experimental inquiry into the correctness of Poisenille's theory of the purgative action of certain salts. He can not see why one should conclude that cathartics purge by means of endosmosis because the blood serum permeates an animal membrane to mingle with the sulphate of soda.

In 1849 Dr. James Blake, of St. Louis, gave a résumé of experiments to determine the quantity of blood by means of sulphate of alumina.

In 1849¶ Dr. J. Locke, of Cincinnati, gave us the principle of the electro-magnetic time marker.

In 1851 Dr. J. C. Walton published his famous researches upon the corpus luteum.

In 1852 Dr. Brown-Sequard gave us the great researches which he had worked out during the past eight years. They are too voluminous to abstract.

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* Electro-Physiology, Morgan's, 1868.

† American Medical Journal, 1840.

‡ American Medical Journal, 1842.

§ American Medical Journal.

‖ New Orleans Medical and Surgical Journal, 1849–'50.

¶ Physiologeische Methodik Gescherdlen.

In 1852 Dr. S. Weir Mitchell published a paper showing that feeding frogs upon sugar produced cataract.

In 1854 Dr. J. C. Walton published his paper upon the movement of the glottis in respiration, demonstrating that during normal respiration there is a constant and regular movement of the vocal cords by which the glottis is alternately enlarged and diminished.

In 1854 Dr. S. Weir Mitchell published a paper upon the relation of the pulse to the respiration. He finds the pulse rate lessened in inspiration and increased in expiration.

In 1854 Dr. Samuel Jackson gave us a paper upon the digestion of fatty matters by the pancreatic juice, confirming Bernard's work.

In 1855 Dr. William A. Hammond published a paper showing the relation of urea to uric acid. He showed that exercise increases urea and diminishes uric acid, while rest diminishes urea and increases uric acid. In his Physiological Memoirs he makes a number of urological contributions, such as the effect of alcohol and tobacco upon the constitution of the urine. He also has a paper upon the nutritive value of albumin, starch, and gum. Another paper is upon the effect of the injection of urea and other substances into the blood. He also contributes a paper upon the action of certain vegetable diuretics.

In 1855 Dr. Joseph Jones published a paper upon the kidneys and its excretion. He states that the amount of excretion depends upon the amount of the force and rapidity of the circulation; the activity of the skin, action of colon, activity of the respiration, *et altera.*

In 1856 Dr. Joseph Jones gave us a paper upon the digestion of albumin and flesh and the comparative anatomy of the pancreas. He confirms Bernard's work.

In 1856 Dr. Francis Gurney Smith made some experiments upon Alexis St. Martin, showing that acid of the stomach is lactic and that amylaceous materials are converted in the stomach into glucose. Dr. Dalton opposed this statement, asserting that the glucose existed in the bread used as food. To this statement Dr. Smith replied by feeding Dr. Brown-Sequard (after washing out his stomach) with arrowroot, which he soon vomited. Glucose was found to be present. No insalivation of the arrowroot was permitted.

In 1856 Dr. Joseph Jones, of Georgia, made a series of experiments, under the direction of Prof. Joseph Carson, on the action of saline solutions of different densities upon living animals and also the reciprocal action through dead animal membranes of serum, water, and saline solution. He concluded that the laws which regulate action of saline solution on living animals can not be demonstrated with dead animal membranes.

In 1856 Dr. Joseph Jones published another paper upon the chemical, physical, and physiological investigation upon the vital phenomena, structure, and offices of the solids and fluids of animals.

In 1856 Dr. J. C. Draper published a paper, "Is urea due to muscular motion?" and experimented upon the respiration.

In 1856 Dr. G. P. Camman published a paper upon the capillaries of the lungs.

In 1856 Dr. J. C. Dalton published a paper on the decomposition of iodide of starch.

In 1857 Dr. J. C. Dalton published his experiments upon the secretion of bile. He made 67 experiments upon animals, showing the different constitution of the bile in different animals, its reaction with gastric and intestinal juices, and lastly its mode of disappearance in the alimentary canal.

In 1857 Dr. Austin Flint, Jr., published a paper upon the phenomena of the capillary circulation.

In 1858 Dr. H. F. Campbell, of Georgia, was the first to announce the theory of reflex secretion and the excito-secretory system of nerves.

In 1859 Dr. J. C. Dalton published a paper upon the physical and chemical changes in the interior of the body.

In 1857 Dr. S. Weir Mitchell published his paper, "Effect of alcohol, glycerin, water gum, ammonia at the vacuum upon the exposed hearts of frogs, snapping turtles, and sturgeons."

In 1860 Dr. S. Weir Mitchell published his valuable monograph upon the venom of the rattlesnake.*

In 1861 Dr. J. C. Dalton published a paper upon the cerebellum.

In 1861 Dr. Austin Flint, Jr., gave us a paper on the points connected with the action of the heart and respiration. His results are as follows: (1) The heart of the dog elongates during systole. (2) The natural stimulus of the heart beat is the blood, and the stimulus can not be supplied by water or any fluid of lesser density. (3) The excitation causing the reflex act of respiration is received from the general system and not from the lungs or heart. The excitation is due to a want of oxygen in the tissues and not to stimulating properties of venous blood.

In 1862 Dr. Austin Flint, Jr., published a paper upon a new excretory function of the liver, showing that cholesterin is removed from the blood and discharged from the body in the form of stercorin.

In 1862 Dr. Austin Flint, Jr., published a paper upon the glycogenic function of the liver.

In 1863 Dr. Austin Flint, Jr., gave us a paper upon the organic nitrogenized principles of the body.

In 1863 Dr. S. Weir Mitchell gave us a monograph upon the physiology of the respiration in cheloma.

In 1863 Drs. Hammond and Mitchell published their experiments upon corroval and NaO.

In 1867 Dr. T. R. Noyes published a paper upon the excretion of urea.

In 1867 Dr. S. Weir Mitchell gave us a paper upon the retrogressive motion in birds produced by the application of cold to the cervical spine.

In 1869 Dr. S. Weir Mitchell published a paper upon the physiology of the cerebellum.

In 1869 Dr. S. Weir Mitchell published a paper upon the insusceptibility of pigeons to opium.

In 1870 Dr. Wm. Lusk published a paper upon the origin of diabetes.

In 1870 Dr. H. C. Wood published a paper upon the physiological action of viridia, veratroidia, and veratria of commerce.

In 1871 Dr. H. C. Wood published a paper upon the action of atropia on birds.

In 1871 Dr. H. C. Wood gave us a paper upon nitrite of amyl, its physiological action.

In 1873 Dr. H. C. Wood gave us a paper upon the action of atropine, and during the same year a paper upon the section of the vagi and the effects of emetics and cathartics.

In 1874 Dr. Austin Flint, Jr., published a paper upon the mechanism of reflex nervous action in normal respiration.

In 1874 Dr. James Putnam published a paper upon the physiology of the cortex cerebri.

In 1874 a monograph upon cocaine, veratria, and gelsemium by the speaker.

In 1874 Drs. H. P. Bowditch and Minot published a paper upon the influence of anæsthetics on the vasomotor centers.

In 1876 Dr. H. P. Bowditch published a paper upon ciliary motion, and in the next year a paper upon the growth of children.

In 1878 Dr. W. H. Klapp published a paper upon the action of strychnia and Dr. James Munro Murray upon the action of aconitia and napellina.

Prof. Robert Meade Smith in the same year published a paper upon the action of sanguinaria.

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* American Medical Journal.

In 1879 Dr. Austin Flint, Jr., published a paper, Experiments and reflections on animal heat.

In 1879 Prof. E. T. Reichert* published a paper on apomorphia.

In the same year Drs. Martin and Hartwell published a paper on the respiratory function of the intercostal muscles.

In 1879 Dr. R. H. Chittenden published a paper on the formation of hydroxanthin from albumin.

In 1879 a paper by speaker on the spinal cord.

In 1879 Drs. Bowditch and Garland published a paper on the effect of respiratory movement on the circulation.

In the same year Dr. Sewall published a paper on the effect of two succeeding stimuli on muscular contraction.

Dr. C. Sibler also published in this year a paper on heat dyspnœa.

As the titles of papers have become too numerous to mention, I shall refer to the number produced each year, as compiled from the Index Medicus. In 1879 there were 36 articles on physiological subjects; 1880, 52; 1881, 21; 1882, 39; 1883, 19; 1884, 26; 1885, 22; 1886, 20; 1887, 44; 1888, 38; 1889, 25; 1890, 17. Having reviewed the past labors of American physiologists, it remains to speak briefly of the present.

The present state of physiology in the United States is in a very promising condition. Unlike England, we are not hampered by licenses and restricted in methods in experimentation. The antivivisectionists are, however, still active, especially in the State of Pennsylvania. It seems to me that the unanimous indorsement of vivisection by the Pan-American Congress would be quite appropriate. The well-furnished laboratories at Boston, Worcester, New Haven, New York, Philadelphia, Baltimore, and Chicago offer great opportunities for anyone endowed with any special love for this work. I say special love, for without it you will not labor long at it, as it is exhausting both financially and physically. As to the future, everything is of a rosy hue. With Mæcenas giving from five to twenty millions to start universities, it ought not to be difficult to have fellowships in physiology at our universities, which should be open to competition, and held as long as the party gives evidence of progress. They should be of sufficient value to attract able young men. At least $1,000 should be the amount of salary. With a few fellowships in physiology the laboratories would be in continual activity, and thus physiological enthusiasm would be stirred up among all concerned. The laboratories themselves should be endowed with a perpetual income, that new apparatus may be built or purchased, for no laboratory of physiology will ever be within any possibility of supporting itself. Money is especially needed to purchase animals, for simians are expensive, but results obtained from them are greatly to be desired, as they more nearly approach us in general constitution. After all, the physiology of man is what we need in our practice as physicians.

THE PHYSIOLOGICAL BASIS OF THERAPEUTIC ACTION; AN EXPERIMENTAL INQUIRY.

By THOMAS J. MAYS, A. M., M. D., of Philadelphia, Pa.,

Professor of Diseases of the Chest in the Philadelphia Polyclinic, and Visiting Physician to the Rush Hospital for Consumptives, of Philadelphia.

In this paper an effort will be made to explain some of the fundamental principles of medicinal action on a physiological basis. I think from the present standpoint of physical science we have great reason for believing that every phenomenon in nature may be viewed as the effect of force, and that therapeutic action, as a part of the grand chain of natural phenomena, becomes intelligible only when it is

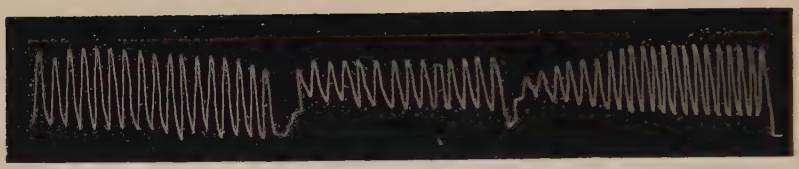
* Philadelphia Medical Times.

reduced to the same terms. This is indeed demanded by the modern doctrine of the conservation of force. From this it follows that any system of therapeutics which fails to take into account the relation between drug action and the outer world must necessarily be imperfect and limited in its practical application. The fireman looks upon the coal with which he fires his engine as the ultimate source of heat, while the philosopher regards the same material as a storehouse of force in the accumulation of which an equal quantity of force was consumed in the sun thousands of years ago, and that ultimately the force which is concentrated here is but a part of the force which pervades the universe. That which is true here is also true of therapeutic action. Heat is applied to the animal organism in various ways. Applied in moderate quantity to a beating frog's heart, as Kronecker has demonstrated, it accelerates the pulsations of this organ, but when applied in greater quantity its pulsations are arrested. When applied in excess, as in the form of steam, or the hot iron, it destroys animal tissue. Now, he who takes a disconnected view of these effects necessarily concludes that heat possesses at least three different properties, (1) that of a stimulant; (2) that of a depressant; and (3) that of an escharotic. But he who believes in the universality of force knows that heat is force, and regards these different phenomena as the varying effects of this force applied in varying quantities.

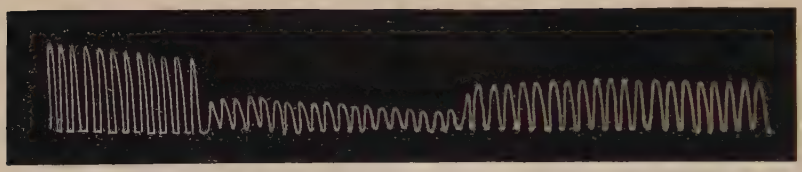
About fifteen years ago I ventured to express the opinion on a purely inductive basis that our therapeutic agents behave like physical forces, inasmuch as in the case of heat they enhance vital action in small and depress it in large quantities. Since then I have investigated this question from an experimental standpoint and believe that I have succeeded in verifying this opinion of the action of a large number of our most important therapeutic agents, at least so far as this stands related to the behavior of the frog's heart. The method which I employed was the following: A frog's heart was securely adjusted to a double canula and then attached to a Kronecker-Bonditch heart apparatus. In this position the heart may be filled with any desirable fluid, and the action of this on the heart may be estimated by the elevation or depression of the tracings which it records on the smoked surface of a revolving cylinder. If it is filled with a 2 per cent solution of blood and receives regularly minimum induction shocks it will continue to beat for many hours in succession, and the elevation of its tracings under such conditions is taken as a standard of the heart's best work. This being constant under the action of the blood solution, any deviation from this normal line which may be brought about by the addition of an agent to the blood solution must hence be ascribed to the influence of such agent.

Before going any further, I wish it clearly understood that in these experiments we must not view the frog's heart as being simply the representative of the heart's function in general, but as that of an isolated organism through which, on account of its vital simplicity and tenacity, and of its peculiar physiological adaptability, we are able to demonstrate and measure the action of different substances on organized animal life.

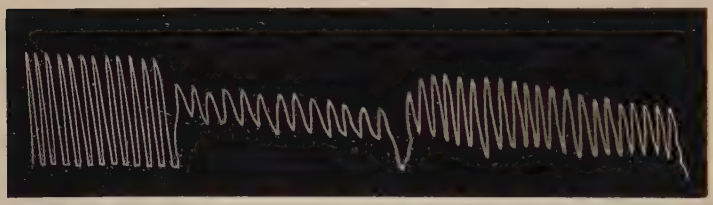
These experiments, as has already been stated, were undertaken with a view of finding whether a drug, in any quantity, added to the 2 per cent blood solution, has the power of producing a higher tracing than that which can be obtained from the blood solution alone. After many trials it was found that all the drugs which were investigated showed such an action in certain doses, which, on account of their diminutiveness, are named minimum doses. On the other hand, it was found that larger quantities paralyzed the heart's action to such a degree that its pulsations were arrested either in systole or diastole, according to the nature of the drug. The quantity which produced this effect is called the maximum dose. This double action is well exemplified in the following tracings which were obtained from sodium hydrate. The minimum dose of this drug was found to be 1:160,000, i. e., one part of sodium hydrate to one hundred and sixty thousand parts of blood; and the maximum dose, 1:1000, i. e., one part of sodium hydrate to one thousand parts of blood.



Atropine. 1:160,000. | Ether sulph. 1:10. | Their combined effects

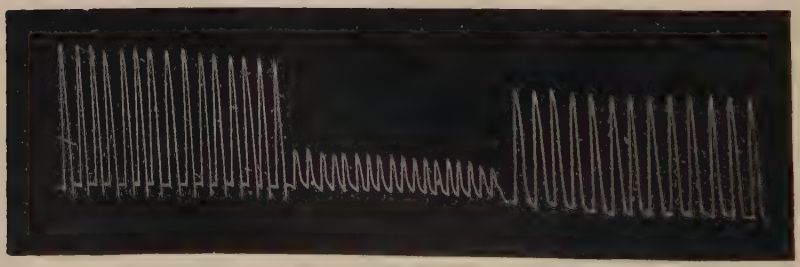


Atropine. 1:160,000. | Alcohol. 1:25. | Their combined effects.



Aconitine. 1:60,000. | Ether sulph. 1:5. | Their combined effects.

Lycopin. 1:160,000. | Chloroform. 1:400. | Their combined effects.

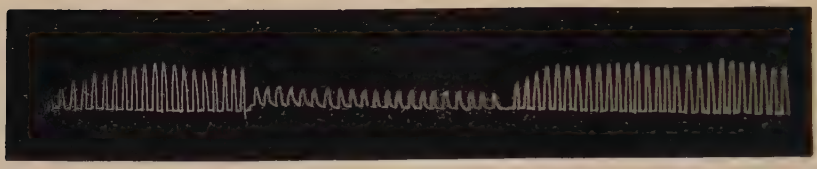


Aconitine. 1:160,000. | Curare. 1:26. | Their combined effects.

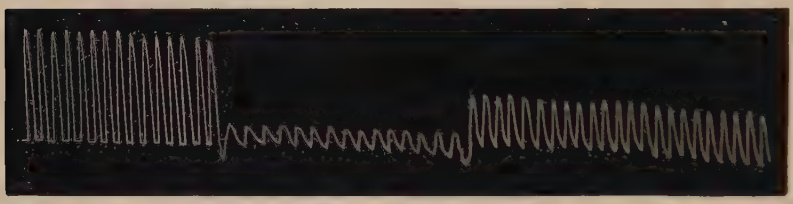
EXAMPLES OF ANTAGONISM.

(Read from left to right.)

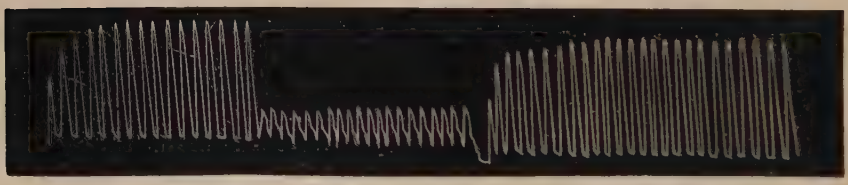
Curare. 1:80,000. | Chloroform. 1:500. | Their combined effects.



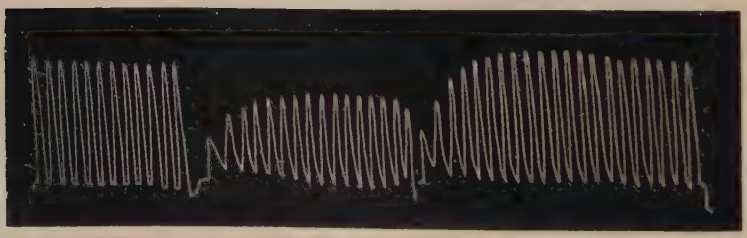
Ether sulph. 1:400. | Chloroform. 1:500. | Their combined effects.



Aconitine. 1:160,000. | Ether sulph. 1:5. | Their combined effects.



Aconitine. 1:160,000. | Chloroform. 1:500. | Their combined effects.

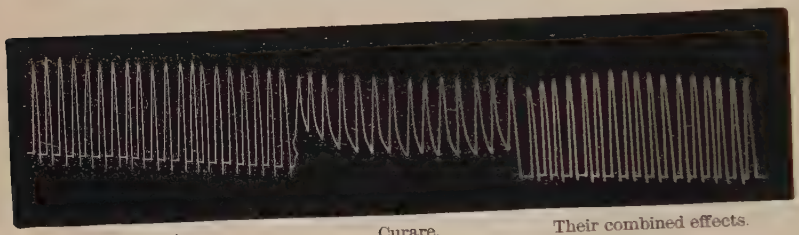


Curare. 1:8,000. | Ether sulph. 1:10. | Their combined effects.

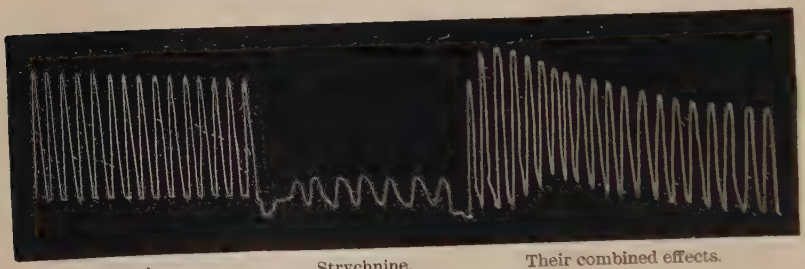
EXAMPLES OF ANTAGONISM.

(Read from left to right.)

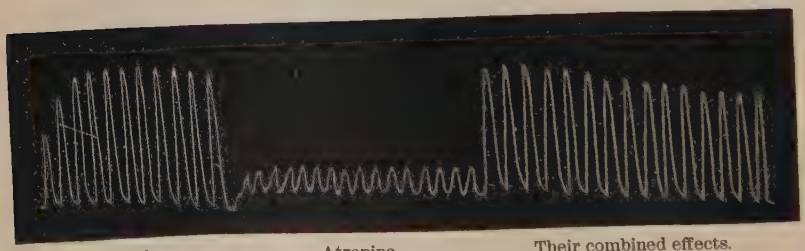
Strychnine. 1:160,000. | Chloroform. 1:500. | Their combined effects.



Atropine. 1:160,000. | Curare. 1:50. | Their combined effects.



Atropine. 1:160,000. | Strychnine. 1:1,000. | Their combined effects.



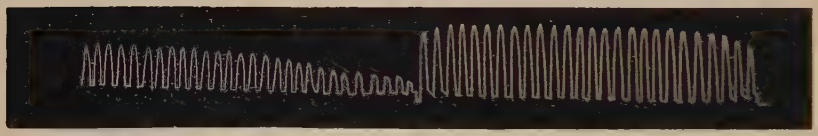
Strychnine. 1:160,000. | Atropine. 1:2,000. | Their combined effects.

EXAMPLES OF ANTAGONISM.

(Read from left to right.)

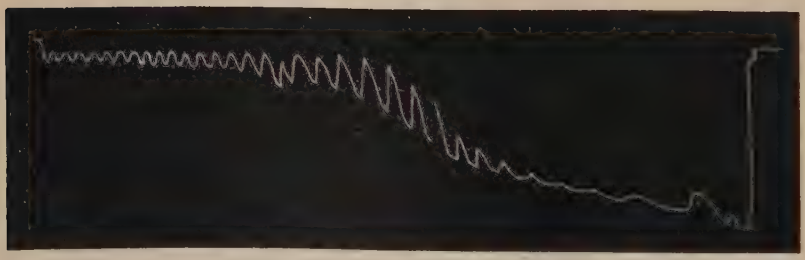
2 p. c. blood sol. Alcohol 1:2,000.

1:666. 1:1,000.



1:400. 1:1,000.

1:25. 1:1,000.



1:5.

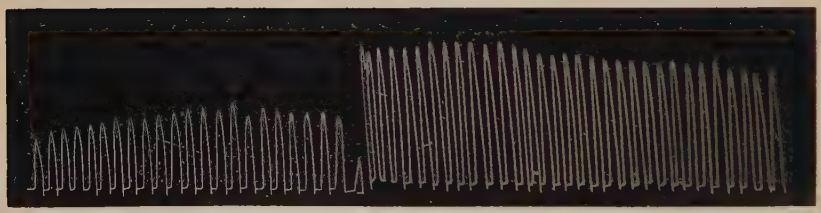
EFFECTS OF MINIMUM, INTERMEDIATE, AND MAXIMUM DOSES OF ALCOHOL.

(Read from left to right.)

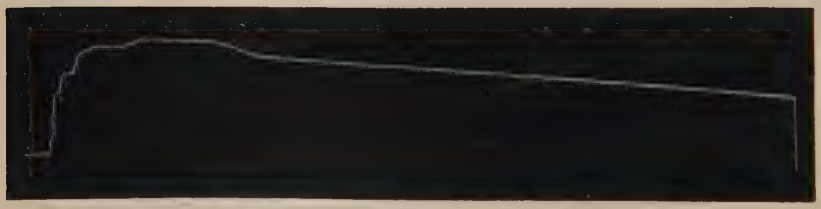
Atropine. 1:160,000. | Chloroform. 1:500. | Their combined effects.

ANTAGONISM BETWEEN ATROPINE AND CHLOROFORM.

(Read from left to right.)



Blood sol. | 1:160,000.



1:1,000.

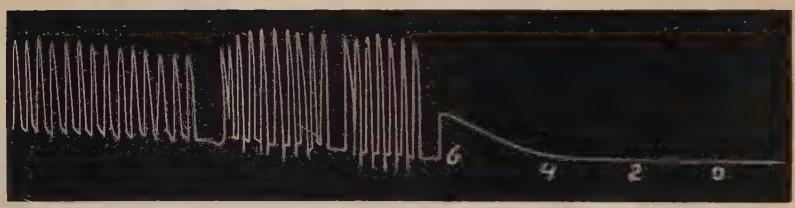
TRACE VI.—Showing the effects of hydrate of soda.

EFFECTS OF MINIMUM, INTERMEDIATE, AND MAXIMUM DOSES OF SODIUM HYDRATE.

(Read from left to right.)

Blood sol. 1:40,000. 1:1,000.

TRACE X.—Showing the effects of hydrate of potash.



Blood sol. 1:2,000. 1:400.

TRACE XI.—Showing the effects of bicarbonate of potash.

Blood sol. 1:4,000. 1:200.

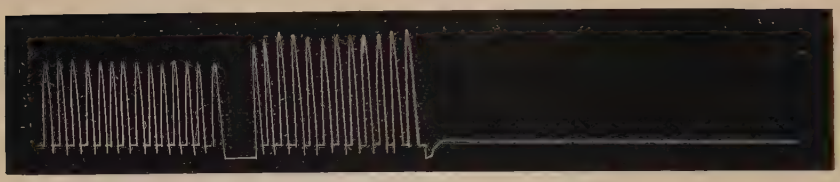
TRACE XII.—Showing the effects of chlorate of potash.

EFFECTS OF MINIMUM AND MAXIMUM DOSES OF POTASSIUM AND SOME OF ITS SALTS.

(Read from left to right.)

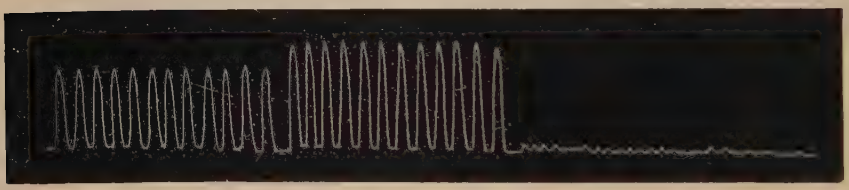
Blood sol. 1:80,000. 1:1,000.

TRACE XXIV.—Showing the effects of digitalin.



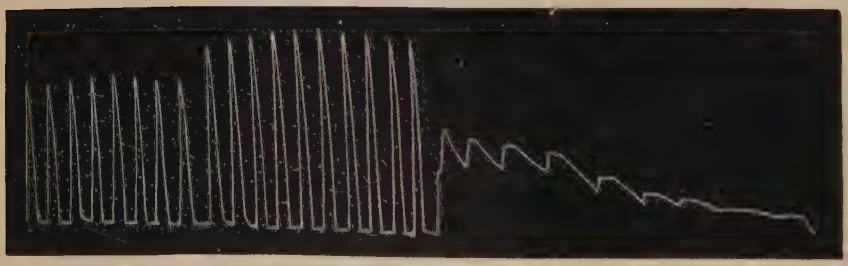
Blood sol. 1:160,000. 1:250.

TRACE XX.—Showing the effects of carbolic acid.



Blood sol. 1:160,000. 1:1,000.

TRACE XXI.—Showing the effects of sulphate of atropine.



Blood sol. 1:320,000. 1:1,000.

TRACE XXV.—Showing the effects of aconitine.

EFFECTS OF MINIMUM AND MAXIMUM DOSES OF DIGITALIN, CARBOLIC ACID, ATROPINE, AND ACONITINE.

(Read from left to right.)

TRACING OF SODIUM HYDRATE.

These tracings show us that the addition of a minimum dose of sodium hydrate to the blood produces higher heart beats than are given by blood alone, and that a maximum dose arrests the heart in systole. This is positive evidence that sodium hydrate when administered in suitable doses is capable of pushing the function of the heart over and above the point which it is capable of exerting in its ordinary state of nutrition; and that on the other hand the same agent when given in large doses has the power of completely inhibiting the heart's action. Now, that which has here been shown to be true of the action of sodium hydrate is also true of the behavior of the following substances which were included in this research, and which are here given in alphabetical order: Acetic acid, aconitine, alcohol, aloin, ammonia, atropine, apomorphine, brucine, ammonia, caffeine, cannabin tannate, carbolic acid, chloric ether, chloroform, chloral hydrate, cocaine, colchicine, conium, curare, delphinine, digitalin, ether, ethyl bromide, gelsemine, guaranine, hydrastine, kairine, lactic acid, lycopin, morphine, corrosive chloride of mercury, piperidine, pilocarpine, potassium and its salts, quassin, quinine, resorcin, sanguinarine, salicin, saponin, spirit of nitrous ether, strychnine, sodium and its salts, theine, and veratrine.

In this connection it is worthy of note, as one of the many interesting phenomena which developed during this investigation, that while large doses would invariably arrest the heart's action, yet this arrest was brought about in either one of the two ways. Such agents as the acids, the potassium salts, aconitine, strychnine, cocaine, curare, chloroform, ether, etc., arrested it in diastole; while the sodium salts, ammonia, digitalin, morphine, quinine, caffeine, theine, etc., arrested it in systole.

These experimental results give us the assurance that all these drugs have at least two kinds of effect on animal life—in minimum doses they exalt normal vital action, and in maximum doses they depress or annihilate the same. Further investigation in the same direction brought out the fact, too, that minimum doses are directly antagonistic in their action to maximum doses. For example, a maximum dose of chloroform, which was found to be one part to five hundred parts of blood, almost entirely inhibits the action of the heart, but when a minimum dose of atropine, which was found to be one part to one hundred and sixty thousand parts of blood, is added to this dose and administered at the same time the tracings may be as high, or even higher, under this combined influence than they are under the influence of minimum doses of this agent, or under the blood itself. This is well shown in the following tracing obtained from chloroform and atropine. The first part of the tracing (*a*) was produced by atropine in a minimum dose, the second part (*b*) by chloroform in maximum doses, and the third part (*c*) by combining a minimum dose of atropine and a maximum dose of chloroform. The same is true of chloroform and strychnine, of atropine and strychnine, and of many other agents as will be seen from the following tracings:

These examples not only give us experimental proof of the power of interference of one drug with the action of another, but they demonstrate the fact how a therapeutic force may be able to overcome and successfully resist the action of disintegrating forces. If we look beneath the surface of these phenomena we find at work here two forces, which, on being properly adjusted, become antagonistic to each other in their action on organic tissue, the one tending to enhance or to elevate, and the other to depress the function of the latter. These antagonistic effects are displayed as decidedly by drug interference as if they were produced by the two mechanical forces of attraction and repulsion, and they give us an exact and measurable demonstration of the power which drugs exert in supporting and preserving life when attacked by adverse forces. Now, if we admit that disease is but the manifestation of the action of morbid forces—forces which move in a direction inimical to health—and if we agree to substitute these in place of the operation of maximum drug doses, as given in the above illustrations, we have a clear picture before us as to the manner in which drugs combat disease, viz, by interference. Now, in what does this principle

of interference consist? What, in other words, is the intimate nature of the combat between drug action and disease? In explaining this we must, of course, take into consideration the fact that in a broad physiological sense all the textures of the animal body are in a state of continual molecular motion, which is maintained principally by internal chemical changes, and that so long as the molecular motion of each texture harmonizes with that of every other, health is the result; but that as soon as perturbation arises among any one or a number of these forces disease must follow. It is readily seen, therefore, how molecular motion may be maintained and enhanced in the body by the introduction of substances, like albuminous and carbonaceous foods, which we know undergo chemical change and apply the force thus arising to this purpose; but how forces—forces of a mechanical nature and which are antagonistic to the bodily forces—can enhance molecular activity is less easily seen, for on the surface it appears as though forces of such a character would naturally tend to produce disintegration under all circumstances.

But that aggressive or antagonistic forces have the power of augmenting healthy molecular motion, under certain conditions, will appear patent from the following observations: If, for example, gentle friction or massage is applied to the body the molecular activity of the latter is at once aroused to its utmost physiological capacity. We have here the antagonism of two kinds of forces—the force of friction or of massage, and those of the tissues to which these were applied—moving in different directions, but which are governed by the same fundamental physical laws, viz, motion takes place in the line of least resistance, and action and reaction are always equal; or, in other words, one force acting on another always calls forth a corresponding reaction. Then, when two forces of equal strength meet each other from opposite directions rest is produced. This is exemplified in the production of darkness by two waves of light. When, however, two forces of somewhat unequal strength come in conflict with each other, the stronger will cause the weaker to move in a direction parallel to its own and to a point where a mutual balance takes place; and although the latter may tend to rebound and to assume its former position, yet, through the operation of a series of such impactions, it will be finally forced to seek a new or another state of equilibrium in which it will remain after the attacking force has ceased to act.

The *modus operandi* of this is well illustrated in the following example: When a gentle gale blows over a wheat field the stalks of grain are generally blown into a leaning position which is more or less permanent; but a steady and continuous wind of equal force applied afterwards from an opposite direction will cause the stalks to become straight again—to resume and to remain in a normal equilibrium after the latter force has ceased to operate. This not only illustrates the intimate nature of the beneficial action of massage and of friction, but that of many other agents, of which strychnine, quinine, atropine, and digitalis in suitable doses are good examples, and shows how the effects of these therapeutic measures, although moving antagonistically to the bodily forces, become permanent in their influence. Moreover, if we view our therapeutic agents in the light of forces, we are not only enabled to explain their action in varying doses and the antagonism of these, as has been done, but we can also account for the fact that many, if not most of our medicines, prefer to act on one tissue rather than on another; or, in other words, we can say why cathartics act on the intestinal canal, emetics on the stomach, digitalis, strophanthus, and caffeine on the heart, cantharides and copaiba on the urinary tract, etc. For the law of the "physiological division of labor" means that the integrity of the body is maintained by many diverse forces or functions within itself, each force or function having its own particular duty to perform; and if an antagonistic force is introduced among so many different forces, widely varying results must be produced—some physiological forces being disturbed, while others are altogether untouched—those showing the greatest opposition or antagonism being most strongly influenced. The phenomena of acoustics give us a fitting illustration

here. Two sounds interfere with each other in proportion to the disparity which exists between them—a small difference causing a slight degree of interference, and two diametrically opposite and equal sound waves will annihilate or neutralize each other, and cause perfect silence. Again, if the tone of E flat is produced simultaneously with the chord C, E, and G, the former will only interfere with the tone E, because it forms a discordant relation with this tone, and an agreeable relation with the other two sounds. The wave E flat therefore antagonizes the wave E only, and leaves the other two waves undisturbed. This principle of action makes it clear, then, why different therapeutic substances should affect different organs; and the same principle carried further also explains why some agents act only on one part, while others act only on another part of the same tissue or organic apparatus. The nervous system, for example, is composed of the same general anatomical elements throughout and possesses the common function of generating and transmitting impulses; yet morphine, cocaine, strychnine, curare, pilocarpine, atropine, hyoscine, gelsemine, hydrastine, and ergotine all affect this system in different regions and in different ways.

Now, while it is true that there is a general uniformity of structure and function of the nervous system, it is also true that there exists special structural and functional differences in this mechanism which are brought about by special requirements and conditions. Thus it is the function of motor nerves to transmit motion, but it is also the function of different parts of motor nerves to transmit different degrees and kinds of motion. The impulses which are transmitted by the nerves of general sensation differ from those which travel along the nerves of special sensation. The pneumogastric nerve supplies the lungs, heart, stomach, liver, and intestines, and its variable and extensive distribution is evidence that the impulses which are conveyed by its branches must differ greatly, for the impulses which have the power of maintaining the function of the heart are not adapted to the necessities of the stomach, nor are those which are essential to the support of the function of the liver suited to the wants of the respiratory apparatus, or to those of the intestines, showing how, on the score of the principle of interference, a therapeutic force may affect a special branch of a nerve and leave all the other branches unaffected.

The fundamental principles of drug action, therefore, resolve themselves into (1) stimulant effects of small doses; (2) depressant effects of large doses; and (3) elective affinity. From this it follows that whatever the elective affinity of a drug may be, the dose which is administered will decide whether it enhances or depresses the function of the organ on which it acts. Hence, when we come to classify the action of drugs, we have stimulants and depressants of every important organ in the body. Thus we have stimulants and depressants of the general nervous system and of special parts of the same, of the heart, lungs, liver, intestines, kidneys, skin, etc., which demonstrates that the old grouping of the action of drugs into stimulants, tonics, narcotics, expectorants, emetics, cathartics, cholagogues, diuretics, diaphoretics, etc., is the only scientific and natural classification. Time and space forbid me, however, from going into the details of this part of my subject any further, and after having run the risk of wearying you nigh unto intoleration I trust I may indulge in the hope that this feeble effort in placing the study of therapeutics on a firmer and more scientific basis than it has heretofore occupied may give an impulse to future inquiry in this direction.

DISCUSSION.

Dr. MaCallum observed that the heart is developmentally the oldest organ in the body, and from the point of view of structure one of the most highly differentiated. One would expect, therefore, that drugs would affect this organ, to a certain extent, differently from the way they would affect a more simple organ, like a simple

cell or a collection of simple cells. To make a fundamental classification of drugs according to their action, an organ such as a simple cell or group of simple cells should form the basis of experiments. Dr. MaCallum has been in the habit of urging the use of ciliated cells for this purpose, and the possibility that they could be studied in this respect by means of Engelmann's Ciliary will, no doubt, when some experienced experimenter should endeavor to carry the use of that instrument beyond that to which Engelmann subjected it, modify it to show finer and more delicate results than the machine gives as it is now constructed. Dr. MaCallum referred to the excellence of the graphic tracings which Dr. Mays obtained to support the contentions of his paper and expressed the pleasure with which he listened to Dr. Mays's paper.

Dr. Mays, of Philadelphia, said he had nothing to add except to warmly thank the members of the section for the kind manner in which they received what he said. He would say, however, that he believed that the experiments of Englemann, at least in part, confirm the result which he had obtained from the heart.

SOME OBSERVATIONS ON NORMAL GROWTH AND DEVELOPMENT OF THE HUMAN BODY UNDER SYSTEMATIZED EXERCISE.

By HENRY G. BEYER, M. D., Surgeon, U. S. Navy.

Some of our best naturalists inform us that the first living things on this globe must have been microscopic, monocellular organisms, inhabiting the surface of the great oceans and leading a free-swimming existence, like the protozoa, their direct descendants, of the present day. Most all of them, furthermore, agree, I think, that there could have been no departure whatever from this monocellularism of existence—no aggregation of cells to build up more complicated organisms could have taken place until some of these protozoa began to assume a sessile form of existence at the bottom of the ocean, whereby nutriment came to them in the current flowing by them, instead of their having to everlastingly hunt for it, and thus expending all their available energy in this direction only. The law of growth and development, in other words, depends on alternate rest and activity, and is one of the oldest and most fundamental in its relation to life in general. Where and however we may study life, whether it is during the embryonic conditions of the higher organisms, or in the adult conditions of both high and low forms of life, we recognize everywhere the existence of resting stages alternating with stages of activity. Thus, in the higher animals, we find the corpuscles of blood and lymph ever active and in constant motion microscopically small. According to the laws of growth they must remain so, but at the bottom of this sea of blood and lymph we find a number of sessile organs, aggregations of cells belonging to the same organism, and made possible only under the same law of alternate rest and activity.

Further reflection and observation have shown this great and fundamental natural law to be at the bottom not only of the evolution of all living forms at present existing, but we can observe it and study its influence in every individual living being. It is consequently clear, then, that growth and development of the human body must be subject to the same unerring laws, and in order that they shall exert their most favorable influence on the formation of that body, they must be duly observed and properly administered. Exercise, alternating with rest, then, are the two most important factors with which scientific physical training will have to deal for the purpose of producing the highest results. Speaking physiologically, there is no difference between the labor performed by the workman and that performed by the gymnast. Both the wood-chopper and the football player do muscular work. But the one has his exercise at his own hours and follows the laws of hygiene, diet, and rest, while the other does not do so, nor can he do so, and we can easily

understand why exercise strengthens the one and wears out the other. Neither does it make any difference to the contracting muscle whether it is made to contract according to the Swedish system, or the German system, or even the American system; as long as it is caused to contract thoroughly and energetically and is allowed to rest after contraction, it will develop and grow in spite of any system.

For a number of years past a system of anthropometric measurements has been introduced into some of our best schools and colleges for the avowed purpose of watching, with more accuracy and scientific exactness than heretofore, the processes of growth and development of the rising generation of Americans as they march through the college gymnasia of these respective institutions. The highest credit and praise are due to the pioneers in this laborious undertaking. The large number of finely equipped gymnasia that have sprung up everywhere like magic must be looked upon as the direct results of their most excellent missionary work in the cause of physical education. But although growth and development are primarily physiological subjects, and therefore should greatly interest physiologists, very little interest has, so far at least, come from that direction. Most of the papers that have appeared, ever since the time of the introduction of these measurements, are most decidedly of more anatomical and anthropometrical interest than of physiological value, and, so far at least, anthropometry has been made an end rather than a means. However, since we have at last succeeded in discovering not only the perfect typical and ideal man, but the woman also, and have had them both safely landed at Chicago, where the two are now supposed to dwell in unison, if not mutual admiration of one another, there is some hope that the leaders in physical education may turn their talents to the much neglected physiological side of this question. Indeed, a beginning has already been made and I have in my possession three papers of the utmost physiological importance as regards physical education. The first of these papers is "The Growth of Children, Studied by Galton's Method of Percentile Grades," by H. P. Bowditch; the second is entitled "The physical basis of precocity and dullness," by W. T. Porter, and the third is "Observations on the results of the pedagogical gymnastics of the Luig system," by Claës J. Enebuske.

The object I had in view in preparing this paper is partly for the purpose of inviting more interest in this subject on the part of physiologists, and partly also to add some observations of my own, made on 50 naval cadets, as ascertained by two successive measurements made at certain intervals, namely: The first measurements were taken in September, 1892, and the second in April, 1893, the time interval between the two measurements being, therefore, about six months. From the whole number of measurements that are usually taken of each individual only a few were selected for consideration here, since to discuss them all would rather detract from the few more important ones selected for our purpose, and would add nothing to the physiological value of the results that may be derived from them all. These items are: (1) The height, (2) the weight, (3) the lung capacity, and (4) the total strength. We will also take into consideration the vital index, the power index, the strength-weight index, and the vital-strength-weight index, which form very important indices, introduced by Enebuske, and all deducible from the first four items. As regards the nature of the gymnastic exercises which the cadets took during the interval of these measurements, I could not say that any one particular system of gymnastics was followed out to the exclusion of every other system. From the point of view of the physiologist there can be but one system, namely, that of common sense and judgment, having for its sole purpose the gradual, progressive, harmonious, and symmetrical development of the individual according to his needs and according to physiological laws, and in this process the instruments used are the subordinate means to the end, no matter to what particular system of gymnastics they may belong.

A brief outline, however, of these exercises seems called for. Thus, during the first month calisthenics or free movements were daily employed, and breathing exercises were practiced on the different chest weights. During the second month

dumb-bells, Indian clubs, and boxing were introduced. During the third month running, jumping, and vaulting were begun. During the fourth month rope climbing, rope jumping, horizontal and parallel bar exercises were done. After that the out-of-door drills began, and the cadets only exercised in the gymnasium in rainy weather, some also doing special exercises prescribed for them in accordance with their special needs and requirements. This is, in brief, the course that was pursued. All had infantry drill, but none had any fencing, which is begun after the first year of their stay at the Academy. The time devoted to gymnastic exercises was one hour per day, except Wednesday, making five hours per week in all, the remainder of the time, of course, being devoted to mental work, with the usual intermissions for recreation common to all schools. The cadets are also taught dancing during the winter, and the weekly Saturday night cadet hops continue throughout the academic year, not all the cadets, however, taking part. It is perhaps but fair to state that the changes that are recorded in the following tables as having taken place in the cadets are not and can not be looked upon as strictly comparative, nor as due to the gymnastic exercises alone, for in order to make them strictly comparative it would require the records of 50 other cadets of the same age and living under the same conditions that had not taken this exercise, and, besides, there were other exercises taken outside the gymnasium and belonging to the Academy curriculum not strictly to be classified as gymnasium exercises. We will begin, then, first with the consideration of their height and see what changes we can detect in that, also what possible standard we may derive from a larger number of cadets that had entered previously to 1892. The records of this Department place at my disposal, so far, two hundred and thirty entries of cadets whose height was accurately measured and recorded upon their entry into the Naval Academy. Inasmuch as there exists no standard for admission to the Academy as regards height for a certain age, except that the candidate, regardless of his age, shall not measure less than 5 feet or 1,624 mm., that he shall be sound and not less than 15 years of age, it seemed promising of some interest to find out just how the average height of the entering naval cadet under this plan compared with that of other schools and colleges from which data for comparison are at hand, taking, of course, the age into consideration in making this comparison.

The following table shows the distribution of the two hundred and thirty cadets, as regards height, in millimeters.

TABLE 1.

Millimeters.	Number of observations.	Millimeters.	Number of observations.
1,850	2	1,625	23
1,825	1	1,600	8
1,800	15	1,575	2
1,775	19	1,550	2
1,750	27	1,525	0
1,725	34	1,500	0
1,700	36	1,475	1
1,675	28		
1,650	32	Total	230

The next table shows their heights, arranged in percentile grades varying from 5 to 95 per cent, as they compare with those of the Amherst students aged 17 years, and those of the Boston schoolboys aged 16, 17, and 18 years, respectively. The average age of the two hundred and thirty cadets is 18 years.

TABLE 2.

[Millimeters.]

Percentile grade.	Average age.	Number of observations.	5.	10.	20.	30.	40.	50.	60.	70.	80.	90.	95.	Average.
Cadet	18	230	1,587	1,611	1,628	1,650	1,656	1,678	1,681	1,725	1,726	1,751	1,775	1,679
Amherst students	17	2,230	1,625	1,647	1,674	1,692	1,710	1,724	1,739	1,756	1,776	1,804	1,827	1,726
Boston schoolboys	18	65	1,602	1,627	1,653	1,666	1,681	1,696	1,710	1,725	1,749	1,788	1,802	1,684
Do	17	128	1,567	1,591	1,630	1,653	1,669	1,686	1,705	1,729	1,746	1,780	1,801	1,684
Do	16	233	1,544	1,573	1,607	1,634	1,656	1,677	1,692	1,707	1,722	1,756	1,783	1,665

This table would show that the height of the naval cadet is considerably below that of the Amherst student, as well as that of the Boston schoolboy, at the same average age, and at the time of his entrance into the Naval Academy. The figures from the Amherst students were derived in part from Tables 5 and 7 of the Anthropometric tables published by Professor Hitchcock in 1892; the age was taken from Table 5 and the percentile grades from Table 7. The figures of the Boston schoolboys were obtained from Prof. H. P. Bowditch's work on "The Growth of Children, Studied by Galton's Method of Percentile Grades," published in 1891.

This comparison, however, is perhaps not perfectly fair, since the above two standards were compiled from part of our population noted for their height, while the cadets come from all parts of the country; they are, however, the only ones so far published, and consequently there was no choice in the matter of selection. The height of the average Yale student, according to Seaver's tables, at the age of 18 years, is given at 1,664 mm., and in accordance with this the average naval cadet would come out from 14 to 15 mm., or about three-fifths of an inch taller than the Yale student of the same age. Since Yale College is a larger school than Amherst, and since it derives its students from a larger territory than the latter, the average height of the Yale student is lower, probably on this account, and approaches more nearly the national average standard. As compared with the Boston schoolboys the naval cadet of 18 years of age approaches more nearly the 16-year-old boy in height than the 17-year-old one. The 50 percentile grade of the height calculated from the two hundred and thirty cadets, at an average age of 18 years, is 1,678 mm., and the same grade of the Boston schoolboys, at an average age of 16 years, is 1,677 mm., or one millimeter less than that; while the average height of the cadets is 1,679 mm., and that of the schoolboys is 1,665, or 14 mm. less. The 18-year-old Boston schoolboy, measuring 1,695 mm. in height, is therefore 16 mm. in advance of the average height of the naval cadet, and the naval cadet is about 15 mm. taller than the Yale student of the same age.

Heights will probably always form one of the most important indices in our calculation and judgment of the physical possibilities of the man. Long bones naturally imply the existence of long muscles to move them, and there seems to be more room in a large frame also for the circumferential growth of the muscles than there is about a small, contracted framework. A capacious thorax, furthermore, will contain a larger lung, implying a greater lung capacity than a smaller one.

In the adjoining two tables of the heights of the fifty cadets, under more special consideration here, it will be noticed that each one of the two tables represents the measurements of twenty-five. Since this division of them is not merely accidental, but purposive, and will appear throughout this paper, it is necessary at the outset to state how and upon what ground this division was made. The principle in accordance with which the total number of cadets was divided is the amount of *increase in total strength* that took place in all between the first and second measurements. Table A contains all those whose increase in total strength was 100 kilos or less, and Table B contains all those whose increase in total strength was above 100 kilos.

Table of heights.

A.

No.	Age.		First measurement.	Second measurement.	Annual gain.	No.	Age.		First measurement.	Second measurement.	Annual gain.
	Yrs.	*mos.*	*mm.*	*mm.*	*mm.*		*Yrs.*	*mos.*	*mm.*	*mm.*	*mm.*
1	16	0	1,663	1,683	20	15	16	7	1,758	1,785	27
2	16	8	1,652	1,659	7	16	20	3	1,618	1,620	2
3	17	3	1,710	1,723	13	17	19	3	1,748	1,750	2
4	18	0	1,730	1,736	6	18	18	8	1,800	1,806	6
5	17	6	1,719	1,721	2	19	19	0	1,730	1,740	10
6	18	5	1,735	1,735	0	20	19	0	1,818	1,820	2
7	19	6	1,775	1,779	4	21	17	3	1,650	1,658	8
8	19	9	1,682	1,688	6	22	17	5	1,766	1,766	0
9	17	0	1,753	1,760	7	23	17	5	1,645	1,649	4
10	18	2	1,688	1,700	12	24	18	0	1,718	1,733	15
11	20	1	1,742	1,742	0	25	16	1	1,780	1,784	4
12	15	3	1,656	1,694	38						
13	17	1	1,695	1,700	5	Averages.	18	0	1,715	1,723	8
14	18	9	1,638	1,645	7						

B.

1	19	11	1,811	1,811	0	15	18	5	1,850	1,850	0
2	16	0	1,693	1,712	19	16	18	7	1,670	1,680	10
3	16	6	1,770	1,781	11	17	19	3	1,720	1,720	0
4	17	9	1,740	1,740	0	18	19	8	1,770	1,770	0
5	19	2	1,708	1,720	12	19	19	5	1,716	1,720	4
6	18	2	1,606	1,610	4	20	15	5	1,633	1,670	37
7	17	3	1,669	1,672	3	21	18	11	1,704	1,712	8
8	18	4	1,698	1,700	2	22	17	9	1,700	1,711	11
9	18	0	1,705	1,712	7	23	16	3	1,730	1,742	12
10	19	0	1,730	1,733	3	24	16	4	1,676	1,695	19
11	19	0	1,810	1,810	0	25	19	7	1,803	1,804	1
12	17	8	1,751	1,754	3						
13	16	7	1,754	1,754	0	Averages.	18	0	1,728	1,735	7.3
14	16	3	1,786	1,792	6						

On comparing the two tables we will find that their various ages average up about the same, namely, 18 years. We find, also, that their increase in height is very nearly the same on the average, but the average height of those on Table A is 13 mm. below that of Table B. Now, the question might well be asked, Is it a mere coincidence, or is it of a certain significance that the members of Table B, who were slightly taller in the beginning than the members represented on Table A, had their total strength increased so much more than the members of Table A, all of them living under the same identical conditions? This question will be more fully discussed in connection with the tables of total strength to be presented later on. The average height, then, of the 50 cadets, at the beginning, and as ascertained by the first measurement, is 1,721 mm., and toward the close of the six months, as ascertained by the second measurement, it is found to be 1,729 mm., showing an increase in the average height of 8 mm., or about one-third of an inch. At present there exists no standard of comparison of the annual or semiannual growth of boys at all ages. An approximation to such a standard of development in height and weight for the pupils of the Boston public schools has been published in the above-mentioned work of H. P. Bowditch for a period of from 5 to 17 years. But inasmuch as Bowditch has shown that this increase is irregular and grows smaller the nearer the individual approaches to its destined maximum size, in order to fairly compare the growth of our cadets we ought to have a standard giving the increase in height above the age of 18 years, this being the average age with which we started. On looking over the tables of Yale students published by Seaver, I find that the height given for students aged 18 years and 6 months, which period would exactly correspond to the average ages of our cadets at the time of the second measurement, is 1,687 mm. or 23 mm., above the height given on the same tables

for 18-year-old ones, and which is 1,664 mm. According to these tables, then, the semi-annual increase in height from 18 to 18½ years would be 23 mm., or nearly 1 inch, for Yale students.

On examining the table of ages of the students at Amherst College, published by Hitchcock, I find that the height given for students of 18 years and 19 years of age is exactly the same; namely, 1,733 mm., apparently indicating no growth at all during the period between 18 and 19 years. Thus it must be admitted, until we have arrived at an exact standard of growth from year to year for all ages up to the twenty-second year of age, it is impossible to state whether the average increase of 8 mm. ascertained for our cadets is above or below the amount that it should be. One thing, however, seems to be clearly established by our tables of comparison alone, and that is this: The average height of the 50 cadets that entered the Academy in the fall of 1892 being 1,721 mm., it is 42 mm., or 1⅔ of an inch, higher than the average height of the 230 cadets who had entered during the last four years, and which is 1,679 mm., as may be seen on Table No. 2.

Annual growth tables, to be of value as standards of comparison, should be published from all the schools and colleges in all parts of the country, and the standards calculated for each year, or fraction of each year, during the entire period of growth. This, I hope, may soon be done, for there is no lack of material on hand now to work them out.

WEIGHTS.

In the adjoining two tables of the weights, the same division of the 50 cadets is presented and carried out according to the same principle as was done in the two tables of the heights, namely, 25 on each table, Table A of the weights presenting the records of the same cadets as Table A of the heights, and Table B of the weights presenting the records of the same cadets as Table B of the heights.

Table of weights.

A.

No.	Age.		First examination.	Second examination.	Gain.	No.	Age.		First examination.	Second examination.	Gain.
	Yrs.	*mos.*	*Kilos.*	*Kilos.*	*Kilos.*		*Yrs.*	*mos.*	*Kilos.*	*Kilos.*	*Kilos.*
1	16	0	50	51	1	15	16	7	70	70	0
2	16	8	56	57.4	1.4	16	20	3	52	52	0
3	17	3	57.3	60	2.7	17	19	3	59	59	0
4	18	0	57.5	61.4	3.9	18	18	8	66.8	70.5	3.7
5	17	6	59.7	65	5.3	19	19	0	59.5	61.5	2
6	18	5	65.5	69.5	4	20	19	0	64.5	71.3	1.8
7	19	6	68.7	71.5	2.8	21	17	3	48	48	0
8	19	9	53.8	57.5	3.7	22	17	5	70	75	5
9	17	0	62	67.5	5.5	23	17	5	52	56	4
10	18	2	53.5	57.5	4	24	18	0	50.5	54	3.5
11	20	1	64.5	69.5	0	25	16	1	57	57	0
12	15	3	51.5	58	6.5						
13	17	1	60	62.9	2.9	Averages.	18	0	59.1	61.7	2.6
14	18	9	58	61.2	3.2						

B.

1	19	11	69	71.1	2.1	15	18	5	72.5	78	5.5
2	16	0	58	59.7	1.7	16	18	7	57.5	62.5	5
3	16	6	69.5	74.2	4.7	17	19	3	59	62.5	3.5
4	17	9	62	63.7	1.7	18	19	8	63.5	65.9	2.4
5	19	2	64.7	67.7	3	19	19	5	62.5	67	4.5
6	18	2	51	52.8	1.8	20	15	5	50.5	53.5	3
7	17	3	61.5	61.9	.4	21	18	11	53.5	57.5	4
8	18	4	55	60.5	5.5	22	17	9	60.5	65.5	5
9	18	0	60	60.5	5.5	23	16	3	57.7	64.2	6.5
10	19	0	66.5	72.3	.8	24	16	4	52.5	59	6.5
11	19	0	67	75	8	25	19	7	71	75.2	4.2
12	17	8	70.6	75.3	4.7						
13	16	7	53	56	3	Averages.	18	0	60.9	64.9	3.9
14	16	3	56.9	61.8	4.9						

On looking at the averages of these two tables, it will be noticed that Table A gives 1.8 of a kilo less than Table B at the start, and that this difference between the two tables grows still greater at the second measurement, when it is found to be 3.2 kilos. The average increase of the first 25 cadets is 2.6 kilos, and the average increase of the second 25 is 3.9 kilos, or 1.3 kilos more. Both averages added together give for the entire number of cadets an average of 60 kilos at the time of the first measurements, and 63.3 kilos for the second measurement, amounting to a semi-annual increase in weight of 3.3 kilos.

From the observations recorded in the paper by Prof. W. T. Porter, of St. Louis, it would appear that precocious individuals are taller as well as heavier, and furthermore that the difference in weight between dull and precocious boys grows greater as they grow older. Since, then, the first 25 cadets, as we have seen so far, are smaller, lighter, and less strong than the second 25, I have examined their examination marks in order to see how Porter's results are borne out here, although our number is not very large. On adding up all their marks and dividing the sum by 25, those of Table A give 57, and those of Table B give 59 as the average, apparently confirming Porter's observations. On turning to Seaver's tables of Yale students, I find the average weight given for 18 years to be 55.4 kilos, and the weight for students of 18 years and 6 months to be 57.6; while the Amherst tables give 61 kilos for the 18-year-old student. The weights of the cadets, therefore, seem to be higher than those of Yale students, and about the same as those of the students at Amherst. So far, then, we have found not only that the members of Table B were taller, heavier, and stronger at the start than the members of Table A, but also that the increase in these qualities was greater as time went on, and in spite of the conditions being identical.

LUNG CAPACITY.

On looking at the two adjoining tables of the lung capacity we will find, although the average lung capacity on Table B is greater than that on Table A at the start, the average increase is about 20 cubic centimeters less on Table B than on Table A. The average lung capacity of the 50 cadets at the first measurement is 4,038, and at the second it is 4,192. This would amount to a semi-annual average increase of 154 cubic centimeters.

Table of lung capacities.

A.

No.	Age.		First measurement.	Second measurement.	Gain.	Loss.	No.	Age.		First measurement.	Second measurement.	Gain.	Loss.
	Yrs.	*mos.*	*c. c.*	*c. c.*	*c. c.*	*c. c.*		*Yrs.*	*mos.*	*c. c.*	*c. c.*	*c. c.*	*c. c.*
1	16	0	3,605	3,768	163	.....	15	16	7	4,669	4,915	246	.....
2	16	8	3,683	3,768	85	.....	16	20	3	3,441	3,849	408	.....
3	17	3	3,522	3,605	85	.....	17	19	8	4,096	4,096	.....	.....
4	18	0	3,441	3,605	164	.....	18	18	8	4,424	4,588	164	.....
5	17	6	3,932	4,096	164	.....	19	19	0	3,768	3,932	164	.....
6	18	5	4,669	4,915	246	.....	20	19	0	5,408	5,408	.....	.....
7	19	6	5,244	5,408	164	.....	21	17	3	3,605	3,686	81	.....
8	19	9	3,683	3,768	85	.....	22	17	5	4,915	4,915	.....	.....
9	17	0	4,096	4,505	409	.....	23	17	5	4,424	4,588	164	.....
10	18	2	3,605	3,768	163	.....	24	18	0	3,683	3,768	85	.....
11	20	1	3,768	3,768	.....	.....	25	16	1	3,683	3,932	.....	.....
12	15	3	3,605	3,932	327	.....							
13	17	1	3,441	4,096	655	.....	Averages	18	0	4,007	4,184	177	.....
14	18	9	3,768	3,932	164	.....							

Table of lung capacities—Continued.

B.

No.	Age.		First measurement.	Second measurement.	Gain.	Loss.	No.	Age.		First measurement.	Second measurement.	Gain.	Loss
	Yrs.	*mos.*	*c. c.*	*c. c.*	*c. c.*	*c. c.*		*Yrs.*	*mos.*	*c. c.*	*c. c.*	*c. c.*	*c. c.*
1	19	11	3,932	4,260	328	.....	15	18	5	5,736	5,736	.....	.....
2	16	0	3,522	3,768	246	.....	16	18	7	3,605	3,932	327	.....
3	16	6	4,424	4,588	164	.....	17	19	3	3,932	4,096	164	.....
4	17	9	3,277	3,768	494	.....	18	19	8	4,177	4,260	83	.....
5	19	2	4,013	4,090	77	.....	19	19	5	4,505	4,588	83	.....
6	18	2	4,441	3,605	164	.....	20	15	5	3,277	3,441	164	.....
7	17	3	3,932	4,096	164	.....	21	18	11	3,932	4,096	164	.....
8	18	4	4,096	3,768	.....	328	22	17	9	4,260	4,096	.....	164
9	18	0	3,441	3,277	.....	164	23	16	3	4,260	4,260	.....	.....
10	19	0	4,752	4,752	.....	.....	24	16	4	3,605	3,768	163	.....
11	19	0	5,324	5,572	248	.....	25	19	7	4,341	4,752	411	.....
12	17	8	4,096	4,096	.....	.....							
13	16	7	4,260	4,260	.....	.....	Averages	18	0	4,070	4,201	157	26
14	16	3	3,605	4,096	491	.....							

It remains to be added that the lung capacities were taken by means of a dry spirometer registering cubic inches, which, for the sake of uniformity, were afterwards converted into cubic centimeters. There is, perhaps, no single subject in connection with physical training upon which more stress should be laid than the necessity of developing the lung capacity. The capability of drawing a sufficient amount of oxygen into the system to supply at all times and under all conditions and circumstances the necessary quantity for the full performance of the functions of every living cell in that system must ever be looked upon as a condition of the utmost importance. It is one of the principal aims of the physical educator. On the other hand, the reserve materials, not being regularly oxidized, would gradually accumulate, and their presence in excess in the economy lead in the end to the most serious disturbances of health through auto-intoxication. Now, the quantity of air introduced into the system at each inspiration being, naturally, regulated by the capacity of the lungs, it is of great importance that the conditions under which muscular work is capable of increasing that capacity should be thoroughly understood. According to Lagrange, too much importance has been attached to the development of those of the muscles that elevate the ribs, and I am sure that the same mistaken idea prevails in this country with regard to the influence on chest capacity to be derived from the use of the popular chest weights.

According to the same author, Demény's conclusions to the effect that more air enters the chest in the attitudes in which the scapulæ are drawn back and fixed by the tonicity and contractions of the rhomboidii, trapezii, and latissimi dorsi muscles, the belly retracted by the aspiration of the viscera into the thorax, than during repose, are entirely wrong. In this condition we find that all the inspiratory muscles except the diaphragm are in a state of forced contraction; the diaphragm alone remains in the position of respiration, and yet this is exactly the condition in which we find ourselves in the so-called position of attention so much insisted upon by the instructors of infantry tactics. The truth of this matter is that whatever is gained in lung capacity by the elevation of the ribs is lost by the ascent of the diaphragm, and, therefore, as an exercise for increasing the lung capacity, the manœuvre is absolutely without value. A similar, if not identical, condition of things prevails during exercises on the various chest weights. If, on the other hand, we will take a very deep inspiration, we find that we are able not only to raise our ribs to the greatest possible limit, but we will also find that the diaphragm, which is the largest and most powerful inspiratory muscle, will share in the movement and will push the abdominal viscera downward, instead of allowing them to be sucked up into the chest, thus materially enlarging the chest capacity. The vertical diameter

of the thorax will be increased in this manner, while in the other condition it was diminished by visceral aspiration. In the opinion of Lagrange, with which we are in perfect accord, the most ingenious gymnastic combinations are not as efficient in increasing the intrathoracic space as are deep inspirations alternating with profound expirations made during repose.

And it is, therefore, not only of no advantage to increase the thickness of the thoracic walls and the muscles covering them, but it forms a direct obstacle to the normal and more natural method of enlarging the intrathoracic space from within. It is from within outward that the force capable of expanding the chest must act, and it is to the lungs themselves, and not to the muscles that the chief share in the changes in form and size of the chest belongs. The most powerful inspiratory muscles can not raise the ribs, unless the lungs themselves participate in the movement of expansion, as every one can find out on himself, and, on the other hand, the lungs can raise the ribs without the aid of the muscles, for the chests of emphysematous people remain vaulted in spite of their efforts to lower the ribs and complete the expiratory movement. In order, then, to enlarge the capacity of the lung, it is clear that we must not attempt to act directly on the muscles that are attached to the chest, but we must prescribe exercises calculated to produce the most extensive respiratory movements, or, in other words, such as produce the greatest respiratory need, and this is a large amount of muscular work done within a short space of time and carefully graded running.

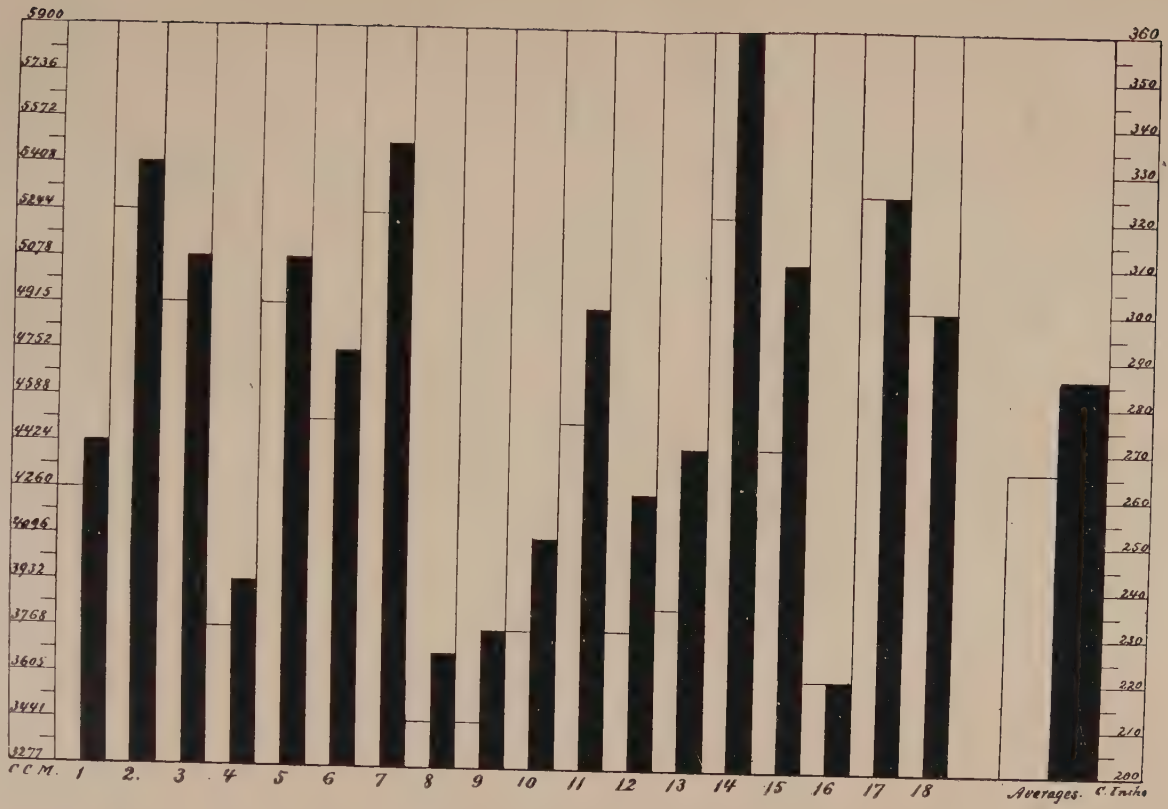
The results which we have attained with the 50 cadets so far as their increase in lung capacity is concerned, while not absolutely poor, are far from being satisfactory to us, and this point will be again referred to under "Vital index."

In the accompanying Table III and Chart I are exhibited the results of some observations on 18 cadets of an average age of 19 years and 3 months, on whom the above detailed principles were carried out as far as that is possible. The special exercise in these cases consisted principally in free movements without apparatus, and carefully graded, progressive running in the open air on a properly constructed running track. They were, in the first place, taught how to breathe properly, how to carry themselves during running, and a point more especially impressed upon their minds was never to run beyond the time when they became fatigued. No fixed period of time was set, because their endurance could very naturally increase but gradually, and must vary daily owing to outside influences over which we have no control. After a very short time, and while strictly following this injunction of never passing the point of fatigue, they all were soon able to run a mile without fatigue, and some very much exceeded that distance, their general health and strength having at the same time very materially increased and improved.

TABLE III.—*Influence of one month's special exercise on lung capacity of 18 cadets.*

[Average age, 19 years 3 months; average height, 1,721 mm.; observations in April, 1892.]

No.	First examination.		First examination.		Gains.		No.	First examination.		Second examination.		Gains.	
	c. c.	*c. in.*	*c. c.*	*c. in.*	*c. c.*	*c. in.*		*c. c.*	*c. in.*	*c. c.*	*c. in.*	*c. c.*	*c. in.*
1	4,260	260	4,424	270	163	10	11	4,505	275	4,915	300	407	25
2	5,244	320	5,408	330	163	10	12	3,678	230	4,260	260	491	30
3	4,915	300	5,078	310	163	10	13	3,849	235	4,424	270	573	35
4	3,768	230	3,932	240	163	10	14	5,244	320	5,900	360	655	40
5	4,915	300	5,078	310	163	10	15	4,424	270	5,078	310	655	40
6	4,505	275	4,752	290	245	15	16	3,605	220	3,605	220	.....	.....
7	5,244	320	5,489	335	245	15	17	5,325	325	5,325	325	.....	.....
8	3,441	210	3,686	225	245	15	18	4,915	300	4,915	300	.....	.....
9	3,441	210	3,768	230	327	20							
10	3,768	230	4,096	250	327	20	Averages	4,352	265	4,683	286	331	20



I.—Influence of special exercise on lung capacity.

The table and chart show that at the end of one month an average increase of 331 cubic centimeters or 20 cubic inches was observed, which amount is twice that observed in the 50 cadets at the end of six months' gymnastic work. During running most all of the muscles of the human body are actively engaged, some more, some less; a large amount of venous blood is poured into the right side of the heart and through the lungs; an immense thirst for oxygen causes the deepest inspiration which, often repeated as they are, must give rise to an increased lung capacity, providing we do not at the same time take too heavy exercises, engaging the muscles that cover and surround the chest, thus tending to compress it from without. It was said above that besides running a large amount of muscular work, *done within a short space of time*, was one of the means of increasing the lung capacity. With regard to this point, I thought it interesting to ascertain what influence on the lung capacity of the players was provided by the popular game of football. The football season at Annapolis begins after October 1, and on October 15 I examined 17 players who were the most likely to continue playing throughout the season with regard to their lung capacities. The same players were examined on November 21, and I must confess my surprise was great when they nearly all came back with the same lung capacities. The only increase in lung capacity that had taken place was noted in two half-backs, just the ones who had to do most of the running. Whether the results of my observations would have been different if I had been able to make my first examination on October 1 instead of the 15th, or not, I am, of course, unable to say; but these observations have gone far to convince me of the fact that if there is any influence in football playing on the lung capacities of the players, that influence must be exerted early in the beginning of the period of training, for after the chest is loaded down with strong, hard muscles, it must become almost impossible for the chest capacity to enlarge to any perceptible extent.

Now, while from a physiological point of view it is perfectly possible and intelligible by the proper exercise to increase the respiratory efficiency of a certain limited area of lung surface without even increasing the capacity of the lung itself, it might, nevertheless, be deemed good advice to attend to the lung capacity according to the best principles before attempting to play the game of football in real earnest. At any rate, as long as the exchange of gases in the lung is simply a physical process, depending upon the difference in partial pressure between the CO_2 contained in the blood on one side of the respiratory mucous membrane and the O of the inhaled air on the other side of this same membrane, the amount of O taken in, and of CO_2 given out, must be looked upon as being in direct proportion to the lobal capacity of the lung as ascertained by the spirometer.

TOTAL STRENGTH.

For the purpose of ascertaining and noting any changes that may have taken place in any individual human being after having had a course of physical training in the gymnasium or elsewhere, it is absolutely necessary that we should have several very thorough tests and established standards of sufficient scientific accuracy easily applied and uniformly accepted and followed, by means of which progress in certain directions can be definitely ascertained and the results compared. Among those that have so far been recommended the total strength test is a most valuable one. When I first began to work with it I must confess I had little confidence in its value, but further experience with it has caused me to look upon it as a most important and significant index. It was for the purpose of still further testing the value of this index that the 50 cadets in question were divided in accordance with the amount of increase in total strength that had taken place during their six months' training in the gymnasium. On looking at the table indicating their total strength, I took 100 kilos as the dividing line, placing those whose increase was less than that on one side, and those whose increase exceeded that limit on the other, and found that they were quite equally distributed, namely, 25 on either side; and,

so far as we have gone, we have found the average height, weight, and lung capacity much in favor of those whose increase in total strength was above 100 kilos, a very significant factor, even if the number of individuals under observation here is not over large. Physiological truths do not require in all cases an overwhelmingly large number of individuals to establish them by, but a smaller number will suffice for them than would suffice for the establishment of the average length of the human femur or the thickness of the thigh.

How is this total strength of an individual calculated? The exact amount of work done by our muscles in complicated cases of labor is by no means easily determined and, in fact, has not been determined except in a few special cases. It is well known that during muscular work of any kind, according to the laws of nature, certain substances are used up, the quantity of which must be subject to calculation from the amount of work that was done, for the law of conservation of energy holds true in the organic as well as in the inorganic world. The amount of work done in these cases is generally expressed in kilogrammeters, 1 kilogrammeter indicating the amount of work necessary to lift 1 kilogram to the height of 1 meter, or 1 gram to the height of 1,000 meters, etc. Thus, the amount of work performed in walking is usually calculated, according to Rubner, by the following formula: 0.071 x k. p., in which formula 0.071 is the product of the height of lift and fall in each step, k. the body weight, and p. the number of steps taken. From the amount of work thus attained it is, on the other hand, easily calculated how much of albumin, carbohydrate, or fat was used up, because the caloric equivalent of work has been found to be 425 kilogrammeters for one calorie, and the number of calories produced by burning certain definite quantities of these substances being also known. But this method, although much more accurate and scientific, merely tells us the amount of energy that is necessary to be expended in certain kinds of special exercise or work, which, furthermore, may be distributed over a longer or shorter space of time. In making serial observations on a large number of individuals we wish more particularly to ascertain what is the total amount of available energy or strength which any of them may bring to bear upon an obstacle to be overcome at any given moment, and to calculate that a more rough and ready method had to be devised and adopted, and this method is the following:

According to the Anthropometric Manual of Amherst College, published in 1889, by Drs. E. Hitchcock and H. H. Seelye, the tests to be taken of an individual whose total strength is to be calculated are as follows:

1. Expiratory strength.—The subject, after loosening the clothing about the chest and filling the lungs, should blow with one blast into the manometer, an instrument made to register the expiratory pressure in kilos and tenths of kilos. Care should be taken that no air escape at the sides of the mouth, and that in expelling the air all the muscles of expiration are brought into play.

2. Strength of back.—The subject standing on the iron foot-rest, with the dynamometer so arranged that when grasping the handle with both hands his body will be inclined forward at an angle of 60 degrees, should take a full breath and without bending the knees give one hard lift, mostly with the back. (See Fig. 1.)

3. Strength of legs.—The subject while standing on the foot-rest, with body and head erect, and chest thrown forward, should sink down by bending the knees until the handle grasped rests against the thighs, then taking a full breath he should lift hard, principally with his legs, using the hands to keep the handle in place over the thighs. (See Fig. 2.)

4. Strength of upper arms; triceps.—The subject while holding the position of rest upon the parallel bars, supporting his weight with arms straight, should let the body down until the chin is level with the bars, and then push it up again until the arms are fully extended. Note the number of times that he can lift himself in this manner.

Fig 1.

Fig. 2.

Fig. 3.

5. Strength of upper arms: biceps.—The subject should grasp a horizontal bar or pair of rings and hang with the feet clear from the floor while the arms are extended. Note the number of times that he can haul the body up until his chin touches the bar or rings.

6. Strength of forearms.—The subject, while holding the dynamometer (Fig. 3) so that the dial is turned inwards should squeeze the spring as hard as possible, first with the right and then with the left hand. The number of kilos may be read off from the dial and noted.

Total strength.—From the above data the total individual strength is calculated as follows: The bodily weight is multiplied by the sum of the dip and pull; this is divided by 10 to prevent too large a number of figures in the calculation. To this is added the strength of back, the strength of legs, the average of the forearm, and the lung strength, and the result is looked upon as the total strength. For example, the weight of the subject being 64, the dip 11 and the pull 12 = 23; the back strength 150, and the leg strength 180; the forearm strength 45, and the lungs 2.0, the result will be: $64 \times 23 \div 10 + 150 + 180 + 45 + 2 = 524$. Just why the strength of the muscles of the upper part of the body was not originally included in this test is now difficult to make out. The strength of both the chest muscles and those that extend between the spinous processes and the shoulder plate can easily be ascertained by one and the same instrument. These are actually given in the New Manual for Physical Measurements, by Dr. Luther Gulick, whose excellently illustrated manual should be in the hands of everyone taking such measurements.

For the sake of uniformity of records we have, however, adhered to the original formula and our tables have all been calculated in accordance with it, so as to make them comparable with those ascertained by all who are taking such tests elsewhere. This strength test is not devoid of all scientific accuracy, but possesses a certain definite physiological value. If we take, for instance, the gastrocnemius of a frog and pass an induction shock through it, we get a contraction, whether we stimulate directly or indirectly. If we attach certain weights to one end of the muscle and increase them gradually and stimulate, there comes a time when our stimulus is no longer answered by a contraction of the muscle and the weight attached to it will no longer be lifted, although the stimulus passes through the muscle as is indicated by the galvanometer. In this condition, in other words, we have arrived at the weight which exactly counterbalances the absolute power of the muscle under observation. In the above-described strength test we have, undoubtedly, an analogous condition of things. The number of kilos which we can lift with our backs and legs being the exact amount necessary to counterbalance the strength of those muscles that were engaged in pulling, in other words indicating their absolute strength just the same as the absolute power is represented by weight in the experiment with the frog's gastrocnemius.

The muscular contraction produced by the stimulus of the will may perhaps not be a maximal contraction and the curve produced in the case may not be anything like the curve produced by a single induction shock, but resemble more nearly a tetanic curve, still the amount of strength that these tests require us to exert at the time represents the greatest possible amount which we are capable of exerting at any one time and which is here expressed in kilos just the same as the absolute power is represented in weight in the experiment with the frog's gastrocnemius.

Total strength table.

A.

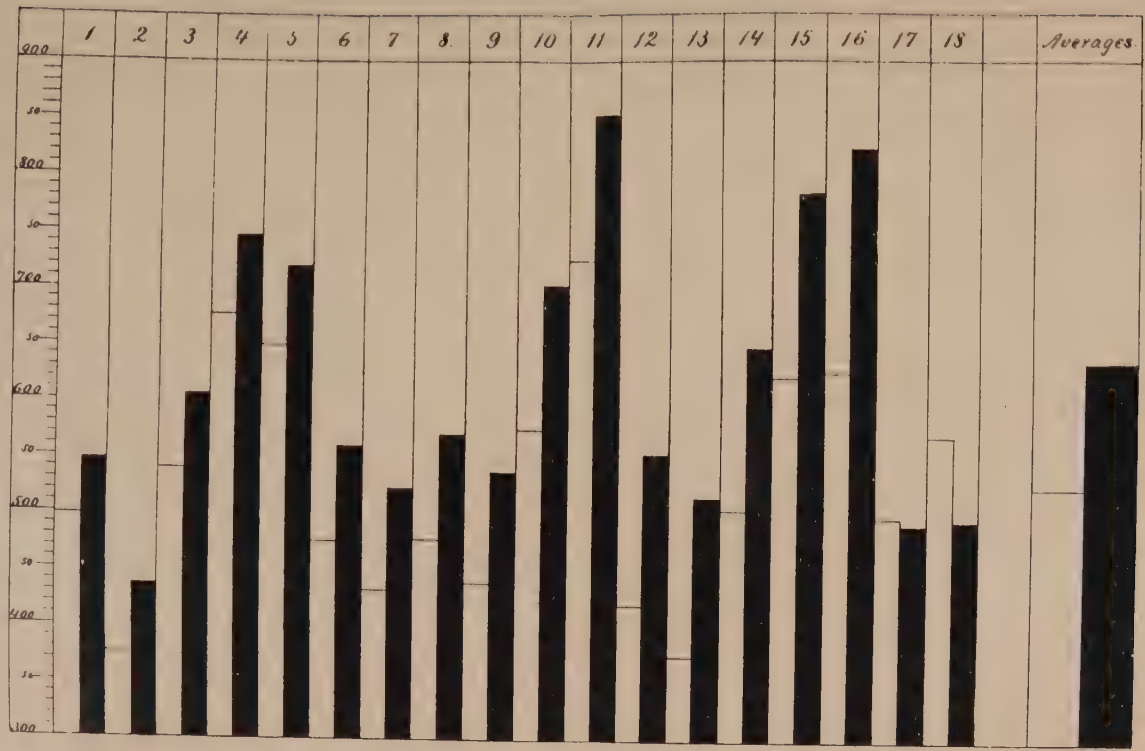
No.	Age.		First examination.	Second examination.	Gain.	No.	Age.		First examination.	Second examination.	Gain.
	Yrs.	*mos.*	*Kilos.*	*Kilos.*	*Kilos.*		*Yrs.*	*mos.*	*Kilos.*	*Kilos.*	*Kilos.*
1	16	0	304	343	39	15	16	7	592	629	37
2	16	8	410	462	52	16	20	3	423	519	96
3	17	3	348	410	62	17	19	3	372	369	97
4	18	0	369	438	69	18	18	8	470	538	68
5	17	6	444	522	78	19	19	0	375	408	33
6	18	5	447	513	66	20	19	0	525	596	71
7	19	6	411	452	41	21	17	3	357	440	83
8	19	9	428	517	89	22	17	5	510	557	47
9	17	0	312	394	82	23	17	5	390	452	62
10	18	2	339	381	42	24	18	0	392	419	27
11	20	1	435	484	53	25	16	1	289	340	51
12	15	3	351	390	35						
13	17	1	310	400	90	Averages.	18	0	390	467	77
14	18	9	549	611	62						

B.

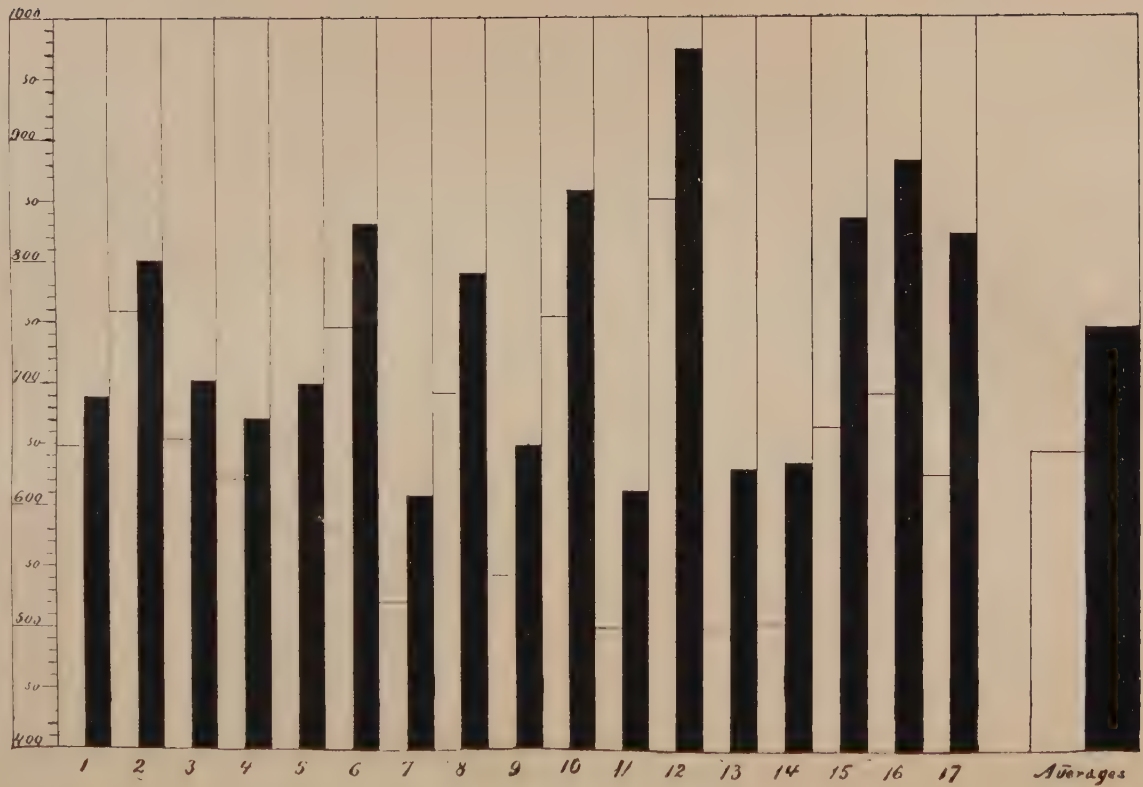
1	19	11	441	604	163	15	18	5	427	539	116
2	16	0	338	494	106	16	18	7	434	552	118
3	16	6	459	640	181	17	19	3	315	498	183
4	17	9	309	430	121	18	19	8	392	804	412
5	19	2	561	824	263	19	19	5	312	498	186
6	18	2	322	432	110	20	15	5	326	512	186
7	17	3	428	608	180	21	18	11	230	463	233
8	18	4	300	412	112	22	17	9	410	542	132
9	18	0	270	389	119	23	16	3	356	519	163
10	19	0	446	579	133	24	16	4	302	425	123
11	19	0	560	672	112	25	19	7	450	575	125
12	17	8	443	812	369						
13	16	7	359	495	136	Averages.	18	0	380	550	170
14	16	5	304	520	216						

On examining the two total strength tables we find that they average up as follows: The 50 cadets on their entrance examination developed an average total strength of 385 kilos, and at their second examination, or about six months later, the average total strength was 508¼, showing a gain of 123¼ kilos, which is the highest average gain ever noted at the Academy between the first and second examinations. Furthermore, when we compare their average strength with that of Amherst students of the same age, we find that the cadets on entering were 35 kilos behind the Amherst students, whose average strength at 18 years, and which is our average age, is given by Hitchcock as 420 kilos; but after the second examination and comparing its results with those obtained from the same students, even at 19 years of age, we find that the cadets are 50 kilos ahead of the Amherst students, whose average strength at that age is given as 448 kilos, while that of the cadets is 508¼ kilos, which is about 20 per cent above the average total strength obtained from 2,230 of the Amherst students.

Looking at Table A, and comparing the average with those of Table B, we find that the average increase of the first 25 is 77 kilos, while that of the second 25 is 170 kilos, although the former were 10 kilos ahead of the later at the first examination. In order to increase one's total strength, however, especially while young and still in the growing period of life, we do not always require very many months to do it in. A month or six weeks of well-directed exercise may add on from 25 to 30 per cent of that strength as is well shown in Table No. IV and Plate II.



II.—Influence of one month's special exercise on total strength of 18 cadets during spring of 1892.



III.—Influence of one month's practice at football on strength of 17 players.

TABLE IV.—*Influence of one month's special exercise on total strength of 18 cadets.*

[Average age, 19 years 3 months; average height, 1,721 mm.; observation made in April, 1892.]

No.	First examination.	Second examination.	Gain.	Loss.	No.	First examination.	Second examination.	Gain.	Loss.
	Kilos.	*Kilos.*	*Kilos.*	*Kilos.*		*Kilos.*	*Kilos.*	*Kilos.*	*Kilos.*
1	498	547	49	.....	11	724	853	129	.....
2	376	436	60	.....	12	419	552	133	.....
3	538	604	66	.....	13	374	514	140	.....
4	674	744	70	.....	14	504	647	143	.....
5	647	717	70	.....	15	621	785	164	.....
6	474	558	84	.....	16	626	824	198	.....
7	431	521	90	.....	17	498	491	.....	7
8	476	568	92	.....	18	569	495	.....	*74
9	438	536	98	.....					
10	573	702	129	.....	Averages	524	636	112	.....

* Sickness.

Table IV presents the same cadets as regards total strength as Table III and Plate I of the lung capacity, the two observations being made, in other words, on the same cadets at the same time. We see that after such a short time as one month's specially directed exercise, which was very light at that, and beginning with an average of 524 kilos, we had obtained an average increase of 112 kilos = 636 kilos. Still more apparent does that become on Table V and Plate III. Here, although the average increase does amount only to 105 kilos, it must be remembered that the initial average strength of the seventeen cadets measured was 644 kilos, and at the end of 5 weeks foot-ball practice it amounted to 747, with a maximum of 974 and a minimum of 612. Assuming, as we must, that there exists a natural individual limit to development in strength, the increase must become slower the nearer we approach that limit, just the same as growth in height becomes slower from year to year as we approach the final limit of our intended height.

TABLE V.—*Influence of one month's practice at football on total strength of 17 players.*

[Average age, 19 years 6 months; average height, 1,765 mm.]

No.	First examination.	Second examination.	Gain.	No.	First examination.	Second examination.	Gain.
	Kilos.	*Kilos.*	*Kilos.*		*Kilos.*	*Kilos.*	*Kilos.*
1	648	689	41	11	500	612	112
2	758	801	43	12	852	974	122
3	654	703	49	13	500	630	130
4	621	672	51	14	504	635	131
5	648	700	52	15	664	836	172
6	746	832	86	16	692	884	192
7	521	608	87	17	626	824	196
8	692	790	98				
9	543	649	106	Averages	642	747	105
10	753	860	107				

VITAL CAPACITY.

The term "vital capacity" as employed in connection with the usual anthropometric records appears to me somewhat misleading, inasmuch as it implies in its meaning a certain physiological significance which it does not possess. The name "vital capacity" was originally used by Hutchinson to denote the respiratory capacity of an individual, and which is usually measured by a modified gasometer (spirometer of Hutchinson), into which the subject breathes, making the most prolonged expiration possible after the deepest possible inspiration. The quantity of air which is

thus expelled from the lungs is indicated by the height to which the air chamber of the spirometer rises, and by means of a scale placed in connection with this the number of cubic centimeters is read off.

The vital capacity as recorded on anthropometric charts in use in our gymnasiums is obtained by different methods, namely:

(1) Seaver (Anthropometry) arrives at it by multiplying the length of trunk, depth of chest, and breadth of chest together; the result is the vital capacity. (2) Gulick (Manual for Physical Measurements) states that the vital capacity refers to the size of the trunk, but "does not represent the cubical size of the body, although it varies in a general way with it." He calculates it by multiplying the length of the trunk by the average between the depth of the chest and the depth of the abdomen, this again being multiplied by the average between the width of the chest and the width of the waist. Just what this so-called vital capacity is intended to represent does not appear to be very clearly defined in the descriptions of the methods for obtaining it. If, as Dr. Gulick states, it does not represent the cubical size of the body, what does it represent? It certainly appears to have little, if any, definite physiological significance so far as a man's chances for life are concerned, for these can simply not be measured in this manner, and if not, why should we continue to apply the term "vital capacity" to what is in reality nothing but the capacity of the trunk?

In the adjoining two tables of the vital capacities, calculated according to Gulick's method, it will be noticed that the losses on both exceed the gains, and we now must ask ourselves how this result has come about. Let us take the example of a boy 18 years of age just entering college and taking a course in the gymnasium for the first time in his life. He is measured in the usual manner, presents a well-developed chest, padded with a goodly layer of adipose tissue, and a well-rounded abdomen. At the end of the academic year and after working well in the gymnasium he is measured again and it is found that he has grown taller, weighs more, is very considerably stronger, and has a greater lung capacity than the year before; but his adipose tissue has almost entirely disappeared and his abdominal walls have become more muscular. Consequently, his abdomen being less rotund; having, furthermore, also increased the strength of his respiratory muscles, he is able to contract his chest better, and the result of both these changes will be that he has lost in vital capacity, much to his chagrin, and it certainly would be most disheartening for him to be told that he had grown taller, heavier, and stronger at the expense of his vital capacity. On the other hand, a man at 40 years of age, the age when in most persons the stomach obtains its final triumph over the chest and permanently establishes its supremacy over the latter, so far as prominence is concerned, will, on being similarly measured, give a greater vital capacity than he did at the age of 25 or 30 years of age, when, perhaps, his physical condition was at its best and his chances for life greatest. I should, accordingly, propose the term "capacity of the trunk" in place of "vital capacity," as ascertained by the methods above detailed. The average vital capacity of the 50 cadets at the first measurement, as shown by these tables, was 3,152 cubic centimeters, and on the second measurement it was 3,085 cubic centimeters, or 67 cubic centimeters less. Since the anthropometric tables so far published by either Hitchcock, of Amherst, or Seaver, of Yale, do not include the vital capacity, it is, of course, impossible to make a comparison.

Table of vital capacities.

A.

No.	Age.		Capacity. First examination.	Capacity. Second examination.	Gain.	Loss.	No.	Age.		Capacity. First examination.	Capacity. Second examination.	Gain.	Lost.
	Yrs.	*mos.*	*c. c.*	*c. c.*	*c. c.*	*c. c.*		*Yrs.*	*mos.*	*c. c.*	*c. c.*	*c. c.*	*c. c.*
1	16	0	2 261	2,745	4.84	.....	15	16	7	3,828	3,381	.....	4.47
2	16	8	3,205	2,999	.....	2.06	16	20	3	2,940	2,727	.....	2.13
3	17	3	3,307	2,750	.....	5.57	17	19	3	3,009	2,967	.....	.42
4	18	0	2,441	3,016	5.75	.....	18	18	8	3,427	3,856	4.29	.....
5	17	6	3,003	2,925	.....	.78	19	19	0	2,925	3,513	5.88	.....
6	18	5	3,570	3,620	.50	.....	20	19	0	3,978	3,853	.....	1.25
7	19	6	3,751	3,556	.....	1.95	21	17	3	2,432	2,449	.17	.....
8	19	9	2,770	2,306	.....	4.64	22	17	5	3,446	3,718	2.72	.....
9	17	0	3,276	3,096	.....	1.80	23	17	5	2,546	2,714	1.68	.....
10	18	2	2,737	2,799	.62	.....	24	18	0	2,964	2,828	.....	1.36
11	20	1	3,081	3,100	.19	.....	25	16	1	2,940	2,589	.....	3.51
12	15	3	2,841	2,496	.....	3.45							
13	17	1	3,197	3,197	.....	.....	Averages	18	0	3,051	3,020	1.07	1.37
14	18	9	2,391	2,295	.....	.96							

B.

1	19	11	4,133	3,243	.....	8.90	15	18	5	4,132	3,978	.....	1.54
2	16	0	2,673	2,916	2.43	.....	16	18	7	3,762	3,924	1.62	.....
3	16	6	3,576	3,531	.....	.45	17	19	3	3,321	3,063	.....	2.58
4	17	9	3,233	3,078	.....	1.55	18	19	8	3,042	3,132	.90	.....
5	19	2	3,126	3,407	2.81	.....	19	19	5	3,367	3,276	.....	.91
6	18	2	3,304	2,590	.....	7.14	20	15	5	3,044	2,436	.....	6.08
7	17	3	3,258	2,898	.....	3.60	21	18	11	2,867	2,541	.....	3.26
8	18	4	3,276	3,180	.....	.96	22	17	9	3,078	3,495	4.17	.....
9	18	6	3,092	2,582	.....	5.10	23	16	3	2,883	2,740	.....	1.43
10	19	0	3,616	3,362	.....	2.54	24	16	4	2,451	2,782	3.31	.....
11	19	0	3,399	3,752	3.53	.....	25	19	7	3,565	3,488	.....	.77
12	17	8	3,056	3,469	4.13	.....							
13	16	7	3,226	3,113	.....	1.13	Averages	18	0	3,252	3,150	.92	1.96
14	16	3	2,827	2,727	.....	1							

VITAL INDEX.

Under the above name, Enebuske has introduced the ratio of lung capacity and weight of Demény. This index appears to me to be of considerable physiological significance in connection with the subject of physical training and the study of its results. From the physiological, point of view the introduction into scientific physical training of valuable and significant indexes, such as the above, is as much of a necessity and of as great importance now as was the introduction of weights and measures into chemistry a hundred years ago.

The original papers of Demény are not accessible to me, but Dr. Enebuske states that Demény has found that in children of the same age the lung capacity is proportional to their weight, and that if a curve is constructed of lung capacity and weight in function of age, the two curves are parallel. Demény has furthermore found that the ratio of lung capacity and weight of persons who have undergone a course of systematic physical training is much higher than in persons who have had no such training, from the fact, familiar to us all, that the training on the one hand increases the lung capacity, and on the other diminishes, at least in the beginning, the weight by causing a great quantity of the reserve tissue (fat) to disappear.

In the adjoining two tables of vital indices I have applied this index to the 50 cadets under observation. It will be noticed, however, that but 16 out of 50 have gained, 31 have lost, and 3 have remained the same. The average vital index obtained from both tables together at the first examination was 0.0679, at the second examination 0.0667, amounting to an average loss of 0.0012.

It will furthermore be noticed that for the first time, so far as we have gone in our comparative study of these two tables, the first table presents higher averages than the second table. It was found, in other words, that the 25 cadets whose increase in total strength was 100 or more kilos, and who are always represented by Table B, were taller, heavier, stronger, and had a greater average lung capacity than the 25 whose increase in total strength had been found to be less than 100 kilos, and who are always represented by Table A. In the tables of the vital indices we meet with the first exception to this. An average decrease in vital index of 0.0012 may not be very great, but it is certainly appreciable, and must have a cause, for I firmly believe in the validity and significance of this index. On referring back to the tables of the lung capacities and taking Table B, it will be noticed that, besides the average increase being smaller than in Table A, 5 out of the 25 have remained the same and 3 have actually lost in lung capacity. No matter how disheartening it may be to realize such results, the finding them out is as important and salutary as the obtaining of contrary results would be gratifying.

Table of vital indices.

A.

No.	Age.		First examination.	Second examination.	Gain.	Loss.	No.	Age.		First examination.	Second examination.	Gain.	Loss.
	Yrs.	*mos.*	*Index.*	*Index.*				*Yrs.*	*mos.*	*Index.*	*Index.*		
1	16	0	0.0721	0.0740	0.0019	.....	15	16	7	0.0671	0.0702	0.0031	.....
2	16	8	.0659	.0656	.....	0.0003	16	20	3	.0661	.0741	.0080	.....
3	17	3	.0614	.0601	.....	.0013	17	19	3	.0694	.0694	.....	.....
4	18	0	.0598	.0587	.....	.0011	18	18	8	.0662	.0650	.....	0.0012
5	17	6	.0658	.0630	.....	.0028	19	19	0	.0633	.0639	.0006	.....
6	18	5	.0786	.0707	.....	.0079	20	19	0	.0779	.0758	.....	.0021
7	19	6	.0763	.0756	.....	.0007	21	17	3	.0749	.0769	.0020	.....
8	19	9	.0684	.0655	.....	.0029	22	17	5	.0702	.0656	.....	.0046
9	17	0	.0660	.0667	.0007	.....	23	17	5	.0851	.0819	.....	.0032
10	18	2	.0674	.0655	.....	.0019	24	18	0	.0729	.0698	.....	.0031
11	20	1	.0542	.0542	.....	.....	25	16	1	.0646	.0689	.0043	.....
12	15	3	.0700	.0676	.....	.0024							
13	17	1	.0573	.0651	.0078	.....	Averages			.0692	.0688	.0011	.0015
14	18	9	.0650	.0643	.....	.0007							

B.

1	19	11	0.0570	0.0600	0.0030	.....	15	18	5	0.0791	0.0735	.....	0.0056
2	16	0	.0594	.0603	.0009	.....	16	18	7	.0626	.0629	0.0003	.....
3	16	6	.0636	.0618	.....	0.0018	17	19	3	.0666	.0655	.....	.0011
4	17	9	.0528	.0591	.0063	.....	18	19	8	.0646	.0646	.....	.....
5	19	2	.0609	.0605	.....	.0004	19	19	5	.0709	.0684	.....	.0025
6	18	2	.0675	.0683	.0008	.....	20	15	5	.0649	.0624	.....	.0025
7	17	3	.0639	.0662	.0023	.....	21	18	11	.0735	.0712	.....	.0023
8	18	4	.0745	.0623	.....	.0122	22	17	9	.0704	.0625	.....	.0079
9	18	0	.0573	.0542	.....	.0031	23	16	3	.0777	.0663	.....	.0114
10	19	0	.0715	.0657	.....	.0058	24	16	4	.0686	.0638	.....	.0048
11	19	0	.0784	.0743	.....	.0041	25	19	7	.0601	.0632	.0031	.....
12	17	8	.0580	.0544	.....	.0036							
13	16	7	.0800	.0761	.....	.0039	Averages	18	0	.0667	.0646	.0008	.0030
14	16	3	.0634	.0663	.0029	.....							

I have for some little time past been dissatisfied with the progress that the cadets have made in breathing capacity consequently this last year, in superintending the exercises, special stress was laid on the importance of breathing exercises on chest weights and special attention was paid to carefully graded running, and I am as firmly convinced that the instruction and drill which the cadets have received in the gymnasium was as well calculated to develop their lung capacities as any that could be devised as I am that the vital index is true and not misleading. What, then, is the cause of the decrease in vital index? I believe it due to the snug-fitting

uniforms in which cadets of this school are done up and which they are obliged to wear the greater part of the day. Although this seems to me quite a reasonable explanation, this fact can only be established by the study of and comparison with the statistics of other military schools. When, however, we compare our average of vital index of the 50 cadets, obtained at the second examination, and which is 0.0667, and find that it is above the average of the 50 per cent Yale student and only below the average vitality of 113 Swedish navy recruits (aged 19), we have, as yet, no great cause for being alarmed, but are, on the contrary, very much encouraged. It is furthermore obvious that any increase in weight, from no matter what cause, may in a few instances cause considerable lowering of the Vi. This would make it appear certain that a high Vi. would be in most cases a sure indication of perfect training, whether it is noticed in children, women, or men. In a large number of scholars doing a certain amount of exercise, especially after the first few months, I have frequently noticed quite considerable increase in weight as a direct result of the exercise, and, as will be noticed on referring to the tables of weights, this average increase in the cases of the 50 cadets is over 3 kilos. Even admitting that a man in perfect training must have a high Vi., the object is not invariably attained in all cases, and more often requires special attention and training.

Our average is higher than that given by Demény of methodically trained Frenchmen aged 22, and which is 0.0615.

As regards the meaning of this index, Dr. Enebuske says:

If we were compelled to translate this index into popular language, we could not come nearer the truth than to say that it means power of resistance during the emergencies of disease,* and that it expresses an essential and fundamental condition for endurance under effort. It does not represent the moral or nerve-dynamic elements of endurance, but it represents a chemico-dynamic component of endurance.

Demény (quoted by Enebuske) makes this statement:

By taking young gymnasts and arranging them according to the decreasing value of their rates of lung capacity and weight, we have been able to ascertain that thereby we have made a classification that corresponds sensibly to their degree of resistance.

In practicing gymnastics Enebuske has observed a marked correspondence between the vital index and ability in such exercises in which the weight of the body is carried by the arms or thrown from the ground by forcible contractions of the muscles of the legs, as jumping and vaulting. Taking perpendicular rope climbing as an example, he found that 6 out of the 26 students examined by him could not climb the rope and that their Vi. was below 0.0478; the remaining 20, whose Vi. was above 0.0478, could all climb except one.

Owing to the fact that the publication of Dr. Enebuske's paper was much delayed, I regret that I was unable this year to test his conclusions in this direction, but this much is certain, namely, that for endurance there is nothing more essential from a physiological point of view than a large lung capacity.

THE POWER INDEX.

This index is the Vi. multiplied by the total strength of the individual. The average power index of the 50 cadets at the first examination was 26.23, and at the second examination it had increased to 33.38, making a difference of 7.15 between

* As to whether we are entitled to this assertion or not, experience in other directions than that of mere gymnastics must prove how this could be brought into harmony with our present understanding of infectious diseases. Comparisons must be made at the bedside. I know of at least one instance which would not bear out this assertion. A gentleman prominent in football, in excellent condition, whom I measured only three weeks before his death, and whose vital index was 0.0782, died of typhoid fever in the surprisingly short time of a week.

the two examinations. Looking over the Amherst table of the 50 per cent student and calculating from the data given there the power index we get a power index of 28.5843 for the average Amherst student.

(See the adjoining two tables of the power indices.)

TABLE A.

No.	Age.		Power index. Po = T. S. / L. C. W.			No.	Age.		Power index. Po = T. S. / L. C. W.		
			First examination.	Second examination.	Gain.				First examination.	Second examination.	Gain.
	Yrs.	*mos.*					*Yrs.*	*mos.*			
1	16	0	21.88	26.75	4.87	15	16	7	39.63	44.03	4.37
2	16	8	24.56	30.03	5.47	16	20	3	27.91	38.40	10.49
3	17	3	21.22	24.66	3.44	17	19	3	17.95	24.35	6.40
4	18	0	21.77	25.84	4.07	18	18	8	31.02	34.97	3.95
5	17	6	28.41	32.88	4.47	19	19	0	23.62	26.11	2.49
6	18	5	31.73	36.42	4.69	20	19	0	40.95	44.70	3.75
7	19	6	31.64	38.77	7.13	21	17	3	26.77	33.88	7.11
8	19	9	29.53	33.60	4.07	22	17	5	35.70	36.20	.50
9	17	0	20.59	26.22	5.63	23	17	5	33.15	37.06	3.91
10	18	2	22.71	24.76	2.05	24	18	0	28.61	29.33	.72
11	20	1	23.27	26.13	2.86	25	16	1	18.49	23.12	4.63
12	15	3	24.85	26.52	1.67						
13	17	1	17.67	26	8.33	Averages.	18	0	27.17	31.62	4.44
14	18	9	35.68	39.71	4.03						

TABLE B.

1	19	11	25.13	36.24	11.11	15	18	5	33.45	39.61	6.16
2	16	0	20.07	26.18	6.11	16	18	7	27.16	34.70	7.54
3	16	6	29.19	39.55	10.36	17	19	3	20.97	32.61	11.64
4	17	9	16.31	25.41	9.10	18	19	8	25.31	51.93	26.62
5	19	2	34.10	49.85	15.75	19	19	5	22.11	34.06	11.95
6	18	2	21.73	29.49	7.76	20	15	5	21.15	31.94	10.79
7	17	3	27.34	40.24	12.90	21	18	11	16.90	32.96	16.06
8	18	4	22.35	25.66	3.31	22	17	9	28.86	33.87	5.01
9	18	0	15.47	21.07	5.60	23	16	3	27.66	34.40	7.74
10	19	0	31.88	38.03	6.15	24	16	4	20.71	27.11	6.40
11	19	0	43.90	49.92	6.02	25	19	7	27.04	36.34	9.30
12	17	8	25.69	44.17	18.48						
13	16	7	28.72	37.66	8.94	Averages.	18	0	25.30	35.14	9.84
14	16	3	19.27	34.47	15.20						

STRENGTH-WEIGHT INDEX AND VITAL-STRENGTH-WEIGHT INDEX.

For the sake of future reference and comparison I append also the tables of these two indices. The strength weight index is expressed by the formula $\frac{T.S.}{W.}$, and the vital-strength-weight index by that of Vi. $\frac{T.S.}{W.}$ The results are recorded in the tables.

Strength-weight indices and vital-strength-weight indices.

A.

No.	First observation.		Second observation.		No.	First observation.		Second observation.	
	$\left(\frac{T.S.}{W.}\right)$	$\left(Vi.\frac{T.S.}{W.}\right)$	$\left(\frac{T.S.}{W.}\right)$	$\left(Vi.\frac{T.S.}{W.}\right)$		$\left(\frac{T.S.}{W.}\right)$	$\left(Vi.\frac{T.S.}{W.}\right)$	$\left(\frac{T.S.}{W.}\right)$	$\left(Vi.\frac{T.S.}{W.}\right)$
1	6.1	0.4392	6.6	0.5148	15	8.5	0.5695	9	0.6300
2	7.3	.4745	8	.5200	16	8.1	.5346	10	.7400
3	6.1	.3721	6.8	.4080	17	4.6	.3086	6.2	.4092
4	6.3	.3717	7.1	.4189	18	7	.4620	7.7	.5005
5	7.4	.4736	8	.5040	19	6.2	.3906	6.7	.4288
6	6.8	.4828	7.4	.5254	20	7.5	.4850	8.4	.6100
7	5.9	.4543	6.3	.4725	21	7.4	.5550	9.1	.7007
8	7.9	.5451	9	.5850	22	7.3	.5110	7.4	.4810
9	5	.3300	5.8	.3828	23	7.5	.6175	8	.6560
10	6.3	.4221	6.6	.4290	24	7.8	.5694	7.8	.5460
11	6.2	.3348	7	.3780	25	5	.3200	6	.4080
12	6.7	.4690	6.7	.4556					
13	5	.2750	6.3	.4095	Averages	6.5	.4355	7.5	.5052
14	9.4	.6110	10	.6500					

B.

1	6.4	0.3648	8.5	0.5100	15	5.8	0.4587	6.9	0.5071
2	5.8	.3445	8.2	.4944	16	7.6	.4757	8.8	.5535
3	6.6	.4197	8.8	.5438	17	5.3	.3529	8	.5240
4	5	.2640	7	.4137	18	6.2	.4005	12.2	.7881
5	8.7	.5298	12.2	.7381	19	5	.3545	7.4	.5161
6	6.3	.4252	8.2	.5600	20	6.4	.4153	9.5	.5920
7	6.9	.4409	9.8	.6487	21	4.3	.3160	8	.5696
8	5.4	.4023	6.8	.4236	22	6.8	.4787	8.9	.5562
9	4.5	.2578	6.5	.3523	23	6.2	.4817	8.1	.5354
10	6.7	.4790	8	.5256	24	5.7	.3910	7.2	.4593
11	8.3	.6307	9	.6687	25	6.3	.3786	7.6	.4803
12	6.3	.3654	10.8	.5875					
13	6.8	.5440	8.8	.6696	Averages	5.4	.3601	8.5	.5491
14	5.1	.3233	8.4	.5569					

HEART RATE.

The association gymnasium record blanks direct that the heart rate should be ascertained before and immediately after the strength tests. Experience has shown that a weak heart beats fast very readily, even on slight exertion, while a strong one does not do so. The principle is perhaps best illustrated by the following table, which belongs to an officer 28 years of age, and who for about a year devoted himself most conscientiously to systematic training:

Number of examination.	July 4.	Oct. 7.	Dec. 16.	Jan. 4.	May 3.
Pulse (1)	100	92	88	88	72
Dip	1	3	6	13	14
Pull	5	11	12	13	12
Back	155	150	170	200	180
Legs	280	310	320	270	325
Forearm	35	45	43	40	40
Strength of lung	25	25	25	20	20
Weight	66.5	61.5	62.5	64	64.5
Pulse (2)	160	134	120	104	110
Total strength	511	593	647	686	714

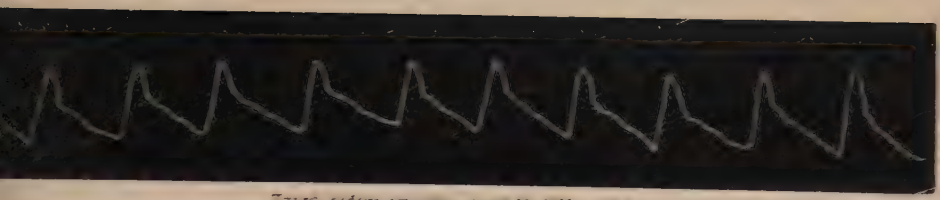
In this diagram we notice a steady decrease in the number of heart beats, not only as regards the initial pulse rate (pulse 1), but also in the rate recorded after the strength test had been taken. This is as it should be.

There is, then, no doubt that a strong and vigorous heart is one of the results of systematized exercise, but this result is only attained not only by the greatest possible care and attention to details on the part of the director of such exercise, but it also requires the most conscientious coöperation on the part of the person taking the exercise. In my experience results like these are exceptional as occurring in pupils that are exercised in classes, and without their receiving individual and quite special care and attention. The more we study the subject of physical training the more also the individual differences and personal peculiarities of mankind become apparent. There are a number of qualities, no less real than those that we can weigh and measure, that are both imponderable as well as immeasurable.

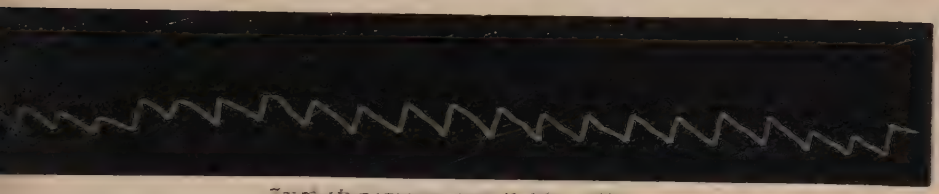
In the 50 cadets under observation the greatest differences with regard to the pulse rate have been observed. Some present a greater initial pulse rate at their second examination than they did at their first examination, and in some even the pulse rate after taking the strength tests was higher at the second examination than it was at the first examination; in some no change has taken place, and in still others marked improvement has been recorded.

By practicing certain forms of exercises we no doubt become able to dominate over certain actions not ordinarily under the control of the will. We learn to regulate the working of our lungs, thus also influencing the heart rate; but it is almost impossible for any one, no matter how well trained he may be, to do his best at these strength tests without at the same time increasing his heart rate to some extent. Indeed, one of the first effects of exercise of any kind is to increase the frequency of the heart beat, as we all know, and consequently to quicken the blood current. No one has ever seen a person doing the "dip" or the "pull" without noticing the pale skin over the working muscles become intensely red and congested looking, owing to the increased amount of blood that is flowing not only to the working muscles, but also to the periphery generally. On making so great an effort in so short a time as these strength tests require, one being taken right after the other, without rest during the intervals, and owing to the large amount of blood which is sent to the periphery in consequence it is, perhaps, quite natural to find the arterial pressure fall and the pulse rate quicken. I have myself not been able, owing to an absence of the proper instruments, to make accurate and conclusive experiments in regard to blood pressure, but the accompanying sphygmograms would go far to render the existence of a lowering of blood pressure after this strength test probable in a majority of cases. Nothing, however, short of accurate pressure tests will decide this most interesting point. Oertel (Handbuch I, Therapie I, Kreislaufs störungen), 1891, in a very painstaking series of experiments, has conclusively shown that the blood pressure rises somewhat on prolonged walking and mountain climbing, also that there is an increased pulse rate. Both these changes in the circulation produced by this form of exercise persist for some time, even after the feeling of fatigue has quite passed away, which latter point has also been observed by Lagrange (loc. cit.). Our results, however, are not comparable to those of Oertel. The curves which we present were taken immediately after a severe effort was made, and before anything like a thorough equalization of venous and arterial circulation could have taken place. The fall in arterial pressure in a sudden effort may be due to the fact that more blood is suddenly thrown into the veins than is returned into the left side of the heart, and also to the incomplete oxygenation of the blood, which must have a depressing effect on the heart itself. Oertel's blood-pressure tests were made hours after the start, consequently long after the balance between venous and arterial circulation had been restored, and the exercise taking place in the open air, the blood after a long walk or climb was in a much improved condition, in so far as oxygenation is concerned, and hence the rise in blood pressure.

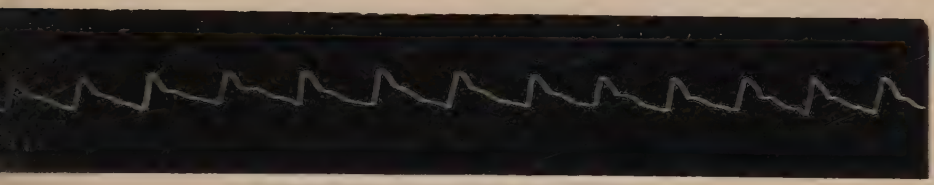
The accompanying diagram (IV) and Table VI, however, show that well-regulated exercise strengthens the heart so that it may resist, as it were, the sudden invasion of effort to a certain extent.



Tzard, before exercise. April 11, 1893. (72.)

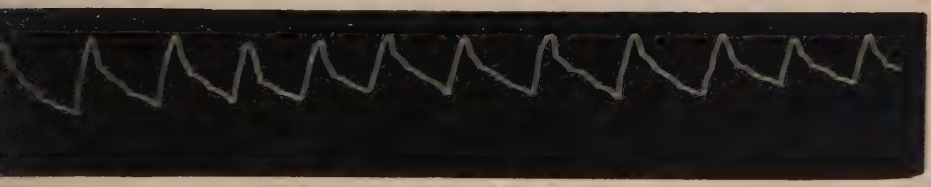


Tzard, after exercise. April 11, 1893. (12.)



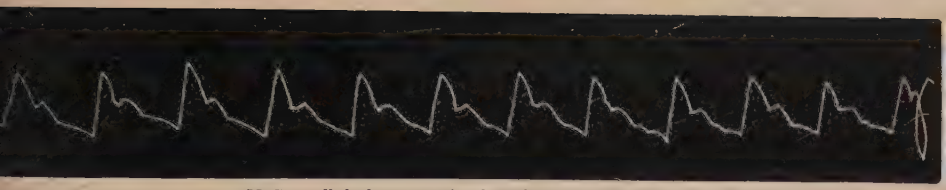
Taussig, before exercise. March 31, —— (72.)

Taussig, after exercise. March 31, —— (12.)

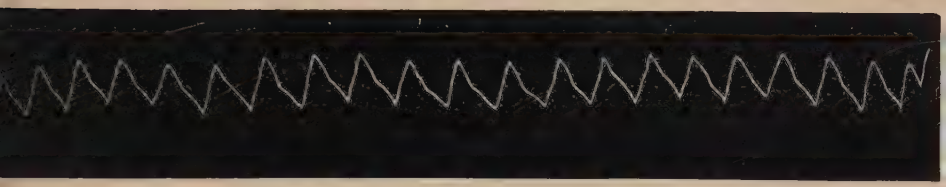


Hall, before exercise. April 14, 1893. (76.)

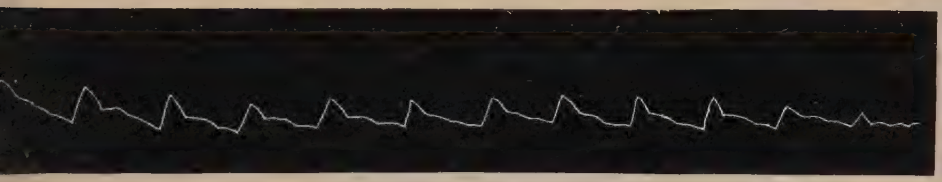
Hall, after exercise. April 14, 1893. (108.)



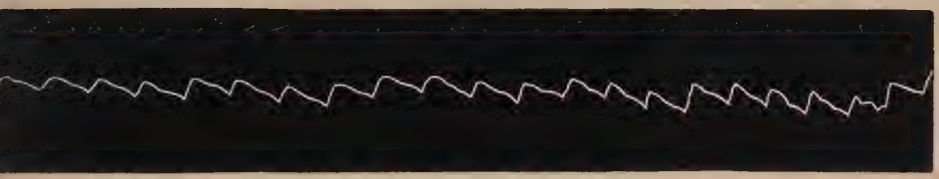
McConnell, before exercise, March 27, ——. (80.)



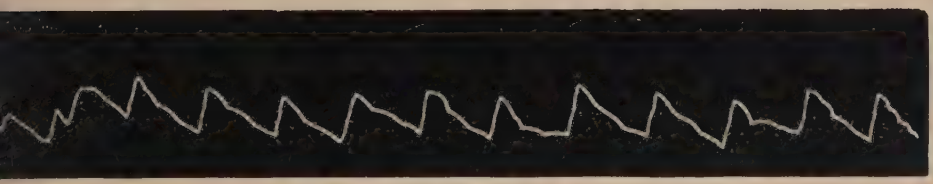
McConnell, after exercise, March 27, ——. (160.)



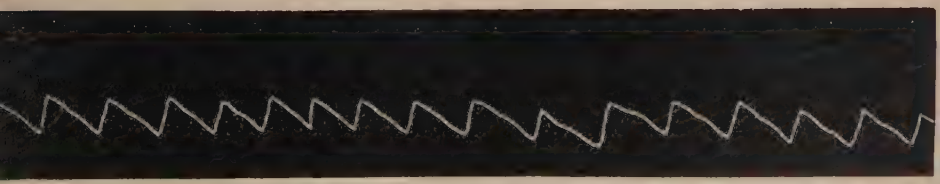
Marshall, before exercise, April 11, 1893. (84.)



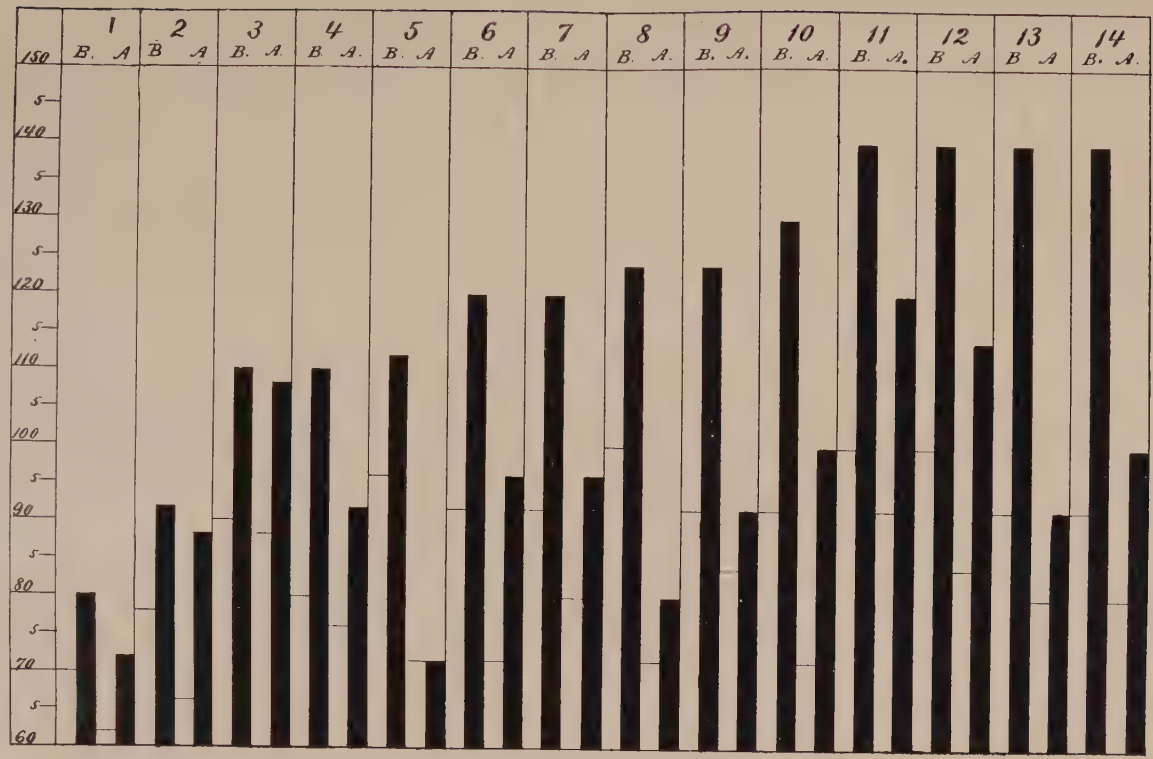
Marshall, after exercise, April 11, 1893. (116.)



Olsen, before exercise, March 28, ——. (80.)



Olsen, after exercise, March 28, ——. (120.)



IV.—Influence of one month's special exercise on heart-rate.

TABLE VI.

No.	Increase in heart rate— Before taking exercise.		After one month's exercise.		No.	Increase in heart rate— Before taking exercise.		After one month's exercise.	
1	70	80	62	72	8	100	124	72	80
2	78	92	66	88	9	92	124	84	92
3	90	110	88	108	10	92	130	72	100
4	80	110	76	92	11	100	140	92	120
5	96	112	72	72	12	100	140	84	104
6	92	120	72	96	13	92	140	80	92
7	92	120	80	96	14	92	140	80	100
Averages	90	120	84	101	Averages	90	120	84	101
Average rate of increase	30		17		Average rate of increase	30		17	

THE GLOBULICIDAL ACTION OF BLOOD SERUM.

By WILLIAM S. CARTER, M. D.,

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It is well known that if we inject into the veins of some animals the blood serum of certain other species of animals there results a hæmoglobinuria and albuminuria. The destruction of red corpuscles has also been observed under the microscope by mixing the blood serum with a drop of blood from another species. This was investigated twenty years ago by Landois * in relation to transfusion. More recently it has been found that blood plasma instead of being simply an inert solution of globulins, albumins, extractives, and inorganic salts, whose chief functions it was to serve as a means of conveying the blood corpuscles to different parts of the body, is really a powerfully active fluid and performs a number of wonderful phenomena. It has been shown that in infectious diseases in which the bacteria are not found in the blood there are in solution in the serum certain products of bacterial metabolism. What seems more important, it has been pointed out by Mettal† and by Buchner‡ and many others that the blood serum of animals refractive to certain diseases is highly destructive to the bacteria causing those diseases. This peculiar function has been called the germicidal or bactericidal action of blood serum and Buchner has shown that it is probably due to a globulin. These observations are very important and indicate that Metchnikoff's well-known theory of phagocytosis is not the only factor in the destruction of bacteria by the blood. The fact has further been established that animals naturally susceptible to certain diseases can be immunized to those diseases by the injection of the blood serum of animals either naturally immune or rendered immune artificially. Furthermore, even after infection has taken place the injection of blood serum of immune animals will promptly neutralize the poison and terminate the disease. This very important practical use of blood serum is certainly the most promising thing of modern medicine and the burning question of the day, for now we are able to cure infectious diseases, and apparently in the way nature cures them. Thanks to Belering, Kilasato, Cantani and Tizoni, and the Klemperers, we are now able to meet tetanus, pneumonia, and diphtheria and not feel that we can not modify the course of the disease.

* Centralblatt für die Med. Wissenschaft., 1873, pp. 883, 897.

† Inaug. Diss., Göttingen, 1890.

‡ Centralbl. f. Bakt., Bd. V, S. 817, & Bd. VI, S. 1.

With these facts before us, the destruction of blood corpuscles by a foreign serum has assumed a greater importance. Recently this property, which has been called the globulicidal action of blood serum, has been studied by Buchner* and by Daremberg.† These observers have independently found that this property was destroyed by heating to 55 to 60° C. for some time, or by dialysis. Buchner further states that this property is lost by preserving the serum for some time outside the body. All these observations, together with those of Maragliano‡ on the globulicidal action of the blood serum in different pathological states, were made on the field of the microscope.

The experiments presented in this paper were made as follows:

The blood serum was obtained (except from man) by introducing, with antiseptic precautions, into the blood vessel a carefully sterilized long glass canula. By this means the blood was received directly into a sterilized glass flask. From man the blood was obtained from the arm after it had been carefully cleansed and washed with antiseptics. The blood was then set aside in the ice chest and allowed to clot. The clear serum was then injected either intravenously or subcutaneously into another animal, by means of a sterilized burette and canula. There was no bacterial contamination in the handling of the serum. The effect upon the blood of the animal thus injected was determined by means of the Thoma hæmocytometer, the diluting fluid being usually a 2.5 per-cent solution of bichromate of potash. The variation between different counts of the normal blood with this instrument is very slight, being on the average not over 200,000 or 300,000. The normal was obtained by counting the corpuscles twice before the injection. After the injection the counts were made as often as possible, or as often as seemed necessary. As each counting occupied considerable time, the condition of the blood could not be determined as often as desirable. The counting and diluting were always done by one person.

The experiments were made chiefly on dogs and rabbits, and the blood was obtained from these animals by sticking their shaved ears. Of course by manipulating the ear so much, the number of leucocytes must of necessity vary greatly, and so great is the variation between different observations in the normal state that unless there be a pronounced and constant change in their number, it can not be ascribed to the injection. In a few instances frogs were used, but it was found that the blood could only be obtained with such difficulty and the number of corpuscles varied so much, normally, from the admixture of lymph, that it did not seem desirable to continue experimentation in this direction.

Besides the numerical observations, it seemed also desirable to examine into the kinds of leucocytes. For this purpose cover-glass preparations were made, fixed, and then stained by eosin and hæmatoxylon. Five hundred leucocytes were counted at each observation and divided into the following classes: (*a*) Lymphocytes, (*b*) large mononuclear, (*c*) transitional, (*d*) eosinophiles, and (*e*) multinuclear.

HUMAN SERUM IN DOGS.

In three experiments in which the human serum was injected in large quantities into the veins of dogs there was no appreciable alteration in the number of the red or white blood corpuscles. Neither was there any alteration in the proportion of the different kinds of leucocytes which were examined in Experiment II.

Experiment I (*dog; weight, 52 pounds*).—12 M.: R. B.C., 6,550,000; W. B. C., 15,000. 12.30: R. B. C., 6,900,000; W. B. C., 31,000. 12.45 P. M.: Injected, per jugular vein, 125 c. c. human serum, 48 hours old, taken from an Italian, aged 48, with aneurism; no symptoms after injection. 2.30 P. M.: R. B. C., 6,800,000. 4.30 P. M.: R. B. C., 7,120,000; W. B. C., 54,000. 6 P. M.: R. B. C., 7,020,000; W. B. C., 37,000. Next day, 10 A. M.: R. B. C., 6,980,000; W. B. C., 25,000. 3 P. M.: R. B. C., 7,000,000.

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* Sitzungsberichte des Ærztlichen Verein, München, II, 1892.

† Arch. de Méd. Expér. et d'Anat. Path., Paris, 1891, Vol. III, 720.

‡ Berl. Klin. Woch., 1892, 765.

Experiment II (*dog; weight, 15 pounds*).—3 P. M.: R. B. C., 7,300,000; W. B. C., 20,000. 3.30 P. M.: R. B. C., 7,125,000; W. B. C., 20,000. 3.45 P. M.: Injected, per jugular vein, 100 c. c. human serum, same as in Experiment I; no symptom. 4.45: R. B. C., 7,700,000; W. B. C., 7,500. 6: R. B. C., 7,050,000; W. B. C., 7,500; urinated freely during night; albuminuria. Next day, 10 A. M.: R. B. C., 8,070,000; W. B. C., 40,000. 3 P. M.: R. B. C., 8,010,000; W. B. C., 45,000.

Experiment III (*dog; weight, 16.5 pounds*).—3 P. M.: R. B. C., 4,400,000; W. B. C., 10,000. 3.30 P. M.: R. B. C. 4,375,000; W. B. C., 6,250. 4.35: Injected, per jugular, 125 c. c. human serum, 6 hours old, from healthy young man, aged 20. 5 P. M.: R. B. C., 4,200,000. 5.45: R. B. C., 4,700,000. Next day: R. B. C., 4,675,000.

Normal: Lymphocytes, 7 per-cent; large mononuclear, 1 per cent; transitional, 2.5 per-cent; multinuclear, 89.5 per-cent.

Two and one-quarter hours after injection of 125 c. c. human serum, 6 P. M.: Lymphocytes, 9.5 per-cent; large mononuclear, 2 per-cent; transitional, 4.5 per-cent; multinuclear, 84 per-cent.

In one experiment (II) albuminuria was observed. The urine did not show any hæmoglobin by Tinct. guiac and peroxide of hydrogen. The kidneys were cut in this experiment and on microscopic examination show the uriniferous tubules filled with granular matter, the outline of the cells showing indistinctly, while the nuclei still take the stain. In order to see if human serum had any toxic effect on dogs, a blood pressure experiment was made in which 100 c. c. of serum from a healthy young man was used. Immediately after the injection there was a slight lowering of pressure, followed by a marked rise to above the normal. The pulse and respiration were at first slowed but soon returned to normal.

From these experiments it would seem that human serum has neither a toxic or globulicidal action upon dogs.

HUMAN SERUM IN RABBITS.

Experiment IV (*small rabbit*).—1 P. M.: R. B. C., 4,750,000; W. B. C., 9.250. 2 P. M.: R. B. C., 4,200,000; W. B. C., 7,750. 3.14 to 3.25: Injected, per vein, very slowly 12 c. c. serum from man with aneurism, æt., 51. 3.26 P. M.: R. B. C., 3,062,000. 3.30 to 3.45: 12 c. c., injected very slowly. 3.50: Paraplegic. 4: R. B. C., 1,070,000. 4.10: Comatose. 4.20: Died in convulsion.

Experiment V (*large rabbit*).—3 P. M.: R. B. C., 6,850,000. 5.33: 12 c. c., human serum twenty-four hours old, rapidly. 5.10: Paraplegic. 5.42: General convulsion. 5.42: R. B. C., 2,900,000. 5.43: Died in convulsion.

Experiment VI (*large rabbit*).—2.30 P. M.: R. B. C., 5,510,000. 3.10 to 3.16: Injected per jugular vein, 19 c. c. serum forty-eight hours old, from young man. 3.16: R. B. C., 2,025,000. 3.16: Died of cardiac failure; no convulsion.

Experiment VI½.—11 A. M.: R. B. C., 4,475,000; W. B. C., 6,250. 11.30: R. B. C., 4,680,000; W. B. C., 17,000. 12.27 to 12.31: Injected rapidly, 5 c. c. serum twenty-four hours old; man with aneurism. 12.35: R. B. C., 2,150,000; W. B. C., 25,000. 12.35: Died, heart failure; R. V. distended; no antemortem clot.

Experiment VII (*medium-sized rabbit*).—3 P. M., R. B. C., 5,250,000; W. B. C., 6,000. 3.30 P. M.: R. B. C., 5,000,000; W. B. C., 7,500. 4.10: Injected slowly per jugular vein, 3 c. c. serum twenty-six hours old, from young man. 5 P. M.: R. B. C., 3,875,000. 5.25: Injected 6 c. c. slowly. 5.30: R. B. C., 3,500,000. Does not seem sick. Next day: Seemed very sick; incoördinate movements; did not seem to have control of posterior extremities; R. B. C., 3,000,000; killed.

Experiment VIII (*medium-sized rabbit*).—4 P. M.: R. B. C., 5,000,000; W. B. C., 6,250. 4.30 P. M.: R. B. C., 5,275,000. 5 P. M.: Injected slowly per jugular vein, 3 c. c. serum two days old, from young man. 5.05: R. B. C., 3,375,000. 5.10 to 5.12: 3 c. c. 5.20: 3 c. c. 5.25: R. B. C., 2,400,000. 5.30: 4 c. c. Slowly. 5.35: Slight convulsion; respiration labored; R. B. C., 1,450,000; died.

Experiment IX (*rabbit*).—A. M.: R. B. C., 6,925,000; W. B. C., 10,000. 8.30: R. B. C., 6,100,000; W. B. C., 40,000. 10 A. M.: Injected per jugular vein, 3 c. c. serum seven days old, from young man, aged 31. 10.30: Breathing rapidly. 10.50: Purging, lying on side. 10.56: R. B. C., 3,075,000. 10.57: Convulsion. 11: Died.

Experiment X.—8 A. M.: R. B. C., 6,650,000. 8.30: R. B. C., 6,500,000; W. B. C., 6,250. 9.30 to 9.35: Injected per jugular 10 c. c. human serum, eight days old, heated up to 55° C. for a moment. 9.45: R. B. C., 3,550,000. 10.10: R. B. C., 3,570,000. 10.30: R. B. C., 4,150,000; W. B. C., 10,000. 10.58: Slight convulsion. 11: Died in convulsion; heart beating on opening chest; right ventricle distended with dark blood, which shows R. B. C., 4,740,000.

Experiment XI (*large rabbit*).—12 M.: R. B. C., 6,825,000; W. B. C., 5,000. 12.30 P. M.: R. B. C., 6,000,000; W. B. C., 9,250. 2.08: 15 c. c. human serum eight days

old, heated to 56° C. for five minutes. 2.20: R. B. C., 4,900,000; W. B. C., 3,000. 2.40: R. B. C., 5,400,000; W. B. C., 3,100. 3: R. B. C., 5,125,000; W. B. C., 9,000. 4.30: R. B. C., 5,275,000; W. B. C., 12,000. No symptoms; complete recovery.

Experiment XII.—9 A. M.: R. B. C., 7,120,000; W. B. C., 7,700. 9.30: R. B. C., 7,025,000; W. B. C., 7,500. 3 P. M.: R. B. C., 7,450,000; W. B. C., 5,000. 3.15: Injected 25 c. c. human serum four days old, from man with aneurism. 4.15: R. B. C., 6,570,000; W. B. C., 6,250. 5.30: R. B. C., 6,950,000; W. B. C., 4,800. 6 P. M.: Urine contained albumin. 6.30: R. B. C., 6,500,000; W. B. C., 13,000. 8: R., 5,400,000; W., 4,700. 9.30: R. B. C., 5,540,000; W. B. C., 7,700. 12, midnight: R., 5,550,000. Next day, 8 A. M.: R., 5,975,000.

Experiment XIII.—12 M.: R. B. C., 6,000,000; W. B. C., 20,000. 12.30: R. B. C., 6,300,000. 1 P. M.: 20 c. c. human serum, eighteen hours old, subcutaneously. 4 P. M.: R. B. C., 6,800,000. 6 P. M.: R. B. C., 6,450,000. Tumor at seat of injection same size as at 2 P. M. Next day, 11 A. M.: R. B. C., 7,350,000. 4 P. M.: R. B. C., 6,000,000.

From these ten experiments it is seen that when human serum is injected slowly into the veins of rabbits the red blood corpuscles are destroyed rapidly, sinking from 5,000,000 or 6,000,000 to 1,000,000, or to one-fifth their number. This destruction occurs within one hour from the time of the injection and during this time the animal usually has several convulsions, frequently dying in one. Palsies sometimes appear—usually a paraplegia. The pupils are dilated and there is a peculiar exophthalmos just at death. The respiration is at first slowed and then becomes labored and the animal usually dies of respiratory failure. When the injection has been rapid death comes on in a few minutes. In these cases there is a rapid destruction of the red blood corpuscles, but never to such an extent as if the injection had been made slowly. The number of corpuscles in these experiments were never reduced below one-half their normal number. In these cases the convulsions are often absent. The disturbance of respiration and the exophthalmos are also present here but the animal dies of cardiac failure.

Recovery has taken place after the injection per vein of 9 c. c. slowly, with the corpuscles reduced to one-half their normal, while on the other hand death has taken place after the exhibition of 3 c. c. of serum several days old, the destruction of corpuscles being very little greater in the latter case than in the former.

With subcutaneous injections there is a very slow absorption and the destruction is very slight and comes on late. There are no toxic symptoms from the use of 25 c. c. in this way. The globulicidal action of human serum was not lost after the serum had been standing seven days, in Experiment IX. In fact, it seemed more toxic, probably on account of some putrefactive process, although there was no bacterial contamination. Momentary heating of blood serum to 55° C. does not lessen the toxicity or destroy the globulicidal action, but when heated for some minutes the blood serum had no effect. There does not seem to be any great change in the number of leucocytes. When there is a great destruction of red blood corpuscles there is also a paucity of leucocytes. There is a slight alteration in the number of lymphocytes when the corpuscles are destroyed. In Experiment IV there was a slight increase in the number of lymphocytes, while there is a corresponding decrease in the number of the multinuclear form, while in VI½ there was no alteration.

Experiment IV.

[Kinds leucocytes.]

	Normal.	Just before death (could only find 50).
	Per cent.	*Per cent.*
Lymphocytes	40.6	40 to 80
Large mononuclear	3	
Transitional	2	or
Multinuclear	53.4	
Eosinophile	1	10 to 20

Experiment VI½.

	Normal.	Just at death.
	Per cent.	*Per cent.*
Lymphocytes	39	38.3
Large mononuclear	6.3	2.3
Transitional	5.3	4
Eosinophile	1	.....
Multinuclear	48.3	55

Albuminuria was present after the subcutaneous injection, but no hæmoglobinuria. In the other cases there was no opportunity of examining for the wind. The kidneys show a very marked structural change; the whole renal tubule seems filled with granular matter and even the nuclei do not take the stain. It is also interesting to note that in these experiments, in which a destruction of red blood corpuscles was taking place, there was a peculiar grouping of those cells and in the field one can see many corpuscles which have lost their color and are very indistinct. In the fixed preparations made for examining the leucocytes, the red blood corpuscles stain very poorly with eosin when they are being destroyed.

HUMAN SERUM IN FROGS.

Experiment XIV (medium-sized frog).—11 A. M.: R. B. C., 425,000. 12 M: R. B. C., 416,000. 1 P. M: Injected 5 c. c. human serum 3 days old subcutaneously. 7 P. M.: R. B. C., 200,000. 12 midnight: R. B. C., 232,000. Next day: R. B. C., 217,000; seems very sick.

Experiment XV (large frog).—3 P. M: R. B. C., 552,000. 4 P. M: R. B. C., 438,000. 5 P. M: 10 c. c. human serum 3 days old. 12 midnight: R. B. C., 310,000. Next day, 3 P. M: R. B. C., 320,000.

Experiment XVI (medium-sized frog).—10.30: R. B. C., 200,000. 11.30: 5 c. c. human serum heated to 55° C. 7 P. M: R. B. C., 260,000.

From this it would appear that human serum has a distinctly globulicidal action upon the corpuscles of a frog when injected subcutaneously.

DOG'S SERUM IN RABBITS.

Experiment XVII (big brown rabbit).—12 M.: R. B. C., 5,260,000; W. B. C., 7,000. 3 P. M.: R. B. C., 4,970,000; W. B. C., 4,500. 3.48: 3 c. c., dog's serum 4 days old injected rapidly. 3.50: Breathing slowly. 3.55: Slight convulsion and died.

Experiment XVIII (white rabbit).—12 M.: R. B. C., 5,600,000; W. B. C., 12,500. 1.49: 1 c. c. dog's serum, 1 day old, injected in jugular vein. 2.10: 1 c. c. 2.20: 1 c. c. 2.25: R. B. C., 4,200,000; W. B. C., 12,000. 2.38: 2 c. c. 2.45: R. B. C., 4,680,000; W. B. C., 6,200. 3: 2 c. c. 3.05: R. B. C., 4,960,000; W. B. C., 6,250. 3.30: 6 c. c. slowly. 3.35: 2 c. c. 3.38: Died; slight convulsion.

Experiment XIX.—1.30: R. B. C., 5,066,000; W. B. C., 7,600. 2.29: 3 c. c. slowly injected into vein. From dog forty-eight hours before 2.42: R. B. C., 5 000,000; W. B. C., 4,000. 3.10 to 3.15: 3 c. c. 3.25: R. B. C., 5,083,000; W. B. C., 1,000. 3.48 to 4: 3 c. c. 4.05: R. B. C., 4,750,000; W. B. C., 3,000. 4.28 to 4.40: 4 c. c. 4.45: R. B. C., 4,880,000; W. B. C., 1,600. 4.55 to 5 38: 9 c. c. 5.40: R. B. C., 5,013,000; W. B. C., 2,100. 6: R. B. C., 4,428,000; W. B. C., 1,170. 6.10: Convulsion; respiration rapid. 6.17: Died in convulsion.

Experiment XX.—3 P. M.: R. B. C., 4,640,000; W. B. C., 12,000. 3.30: R. B. C., 4,400,000; W. B. C., 5,000. 4 to 4.45: 8 c. c. injected into vein, very slowly, dog's serum 4 days old. 4.50: R. B. C., 5,040,000; W. B. C., 10,000. 5.10: R. B. C., 4,800,000; W. B. C., 10,000. 5.15 to 5.40: 7 c. c. 5.40: R. B. C., 5,200,000; W. B. C., 11,000. 5.45 to 6.25: 13 c. c. 6.10: R. B. C., 5,100,000; W. B. C., 7,700. 6.27: 5 c. c. 6.30: R. B. C., 5,400,000; W. B. C., 12,500. Next day: R. B. C., 5,200,000; W. B. C., 9,375. Next day: R. B. C., 5,800,000.

Experiment XXI.—3 P. M.: R. B. C., 5,700,000; W. B. C., 5,600. 3.30: R. B. C., 6,022,000; W. B. C., 3,800. 3.52: 5 c. c., dog's serum, 1 day old. subcutaneously. 4 P. M.: 5 c. c. 4.15: R. B. C., 6,000,000. 4.45: 15 c. c., subcutaneously. 6: R. B. C.,

5,360,000; W. B. C., 8,600. 6.30: R. B. C., 6.160,000; W. B. C., 9,000. Next day: R. B. C., 4,460,000; W. B. C., 4,300; albuminuria and haemoglobinuria. Next day: R. B. C., 4,170,000; W. B. C., 6,500; urine as yesterday. Next day: R. B. C., 4,690,000; W. B. C., 8,300.

Experiment XXII.—10.45: R. B. C., 6,400,000; W. B. C., 1,500. 12.30: R. B. C., 6,840,000; W. B. C., 11,000. 2.06: Injected 20 c. c. dog's serum, 4 days old, subcutaneously. 3: R. B. C., 7,500,000; W. B. C., 1,500. 4: R. B. C., 7,112,000; W. B. C., 10,000. 6 P. M.: R. B. C., 8,380,000; W. B. C., 6,200. Next day: R. B. C., 7,280,000; W. B. C., 7,000.

Experiment XXIII.—10.30: R. B. C., 6,010,000; W. B. C., 3,360. 12 30: R. B. C., 6,400,000; W. B. C., 6,000. 1.50: injected 15 c. c. dog's serum subcutaneously (several days old). 2.45: R. B. C., 6,030,000; W. B. C., 10,000. 4: R. B. C., 6,360,000; W. B. C., 18,000. 5.45: R. B. C., 6,200,000; W. B. C., 13,000. Next day: R. B. C., 6,100,000; W. B. C., 9,100.

Experiment XXIV.—2 P. M.: R. B. C., 5,630,000; W. B. C., 7,000. 2.30: R. B. C., 5,320,000; W. B. C., 7,600. 4.45: 25 c. c. dog's serum, 1 day old, subcutaneously. 9: R. B. C., 5,400,000; W. B. C., 7,800. 12: R. B. C., 5,500,000; W. B. C., 7,400. Next day, 6 A. M.: R. B. C., 5,400,000; W. B. C., 13,000. 9 A. M.: R. B. C., 5,960,000; W. B. C., 16,000. 12 noon: R. B. C., 5,400,000; W. B. C., 10,000. 7 P. M.: R. B. C., 5,060,000; W. B. C., 6,600. Next day: R. B. C., 5,500,000; W. B. C., 10,000.

Experiment XXV.—2.30: R. B. C., 6,500.000; W. B. C., 14,000. 5.15: 25 c. c. dog's serum, 1 day old, subcutaneously. 9 P. M.: 5,800,000; W. B. C., 9,500. 12 midnight: R. B. C., 6,800,000; W. B. C., 6,250. Next day, 7 A. M.: R. B. C., 6,520,000; W. B. C., 16,000. 12 noon: R. B. C., 5,800,000; W. B. C., 12,000. 7 P. M.: R. B. C., 6,800,000; W. B. C., 9,200. Next day: R. B. C., 6,400,000; W. B. C., 9,000.

With dog's serum, as with the serum of man, the rapid injection by the vein causes death in few minutes, often without convulsion. When the injection is made slowly, however, large quantities can be used, convulsions and death coming on late, or there may be entire recovery, even after 33 c. c. has been injected, as in Experiment XX. The toxic effect is not noticed until just before death, and is not as great as in rabbits injected with the serum of man. The globulicidal action is not very pronounced, the corpuscles never being reduced below four-fifths the normal quantity, and in several experiments there was scarcely any destruction. The diminution was no greater in the fatal cases than in those terminating in recovery. The white blood corpuscles did not undergo any decided numerical change, but there was a distinct alteration in the proportion of the different kinds. There was a distinct increase of the lymphocytes or the youngest leucocytes and a corresponding reduction of the multinuclear form, or the oldest leucocytes. By the subcutaneous injection there was in one case a decided diminution of red blood corpuscles to four-fifths their normal quantity, and at the same time albuminuria and haemoglobinuria (Experiment XXI). The effect came on the day after the injection. I repeated this experiment four times, in apparently the same way, and even using larger quantities, but never obtained similar results; the only result of the injection in these cases was an albuminuria.

The kidney of the rabbit injected with serum from dog a shows decided structural change, being similar to that resulting from the injection of serum of man, but not so severe. Ten c. c. of dog's serum one day old was injected subcutaneously in a frog, and the frog was found dead six hours later.

The results of injecting dog's serum into rabbits are different from those obtained by others in mixing dog's serum and rabbit blood. Landois, Buchner, and Daremberg all found dog's serum very destructive to the corpuscles of the rabbit. My experiments seem to warant the conclusion that dog's serum is toxic, but much less so than the serum of man, and that it is scarcely at all globulicidal. The globulicidal action certainly could not explain the toxicity, for in the cases ending in death there was no greater destruction of corpuscles than in those ending in recovery.

Varieties of leucocytes, dog's serum in rabbit.

EXPERIMENT XVII.

	Normal.	Just at death.
	Per cent.	*Per ent.*
Lymphocytes	44	77
Large mononuclear	3	6.5
Transitional	3	2
Eosinophile	.5	.2
Multinuclear	50	14.3

EXPERIMENT XIX.

	Normal.	2.45 P. M.	3.45 P. M.
	Per cent.	*Per cent.*	*Per cent.*
Lymphocytes	21.6	18.2	38
Large mononuclear	3.3	4.4	4
Transitional	4.4	3.4	1
Eosinophile	1.2	1.4	1
Multinuclear	69.7	72.6	56

EXPERIMENT XXI.

	Normal.	5 P. M.	Next day, 3 P. M.	4 days afterwards.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Lymphocytes	28	29	42	62
Large mononuclear	15	8	2	3
Transitional	5	7	3	3
Eosinophile	2	2	.....	.6
Multinuclear	50	54	53.5	30

HORSE'S SERUM IN RABBITS.

Experiment XXVI (large rabbit).—4.30: R. B. C., 5,742,000; W. B. C., 5,800. 5.30: R. B. C., 5,960,000; W. B. C., 6,500. 8.08 to 8.10: 12 c.c. horse serum 3 days old, injected per jugular vein. 8.10 to 8.18: 14 c. c., slowly. 8.30: R. B. C., 5,166,000; W.B.C.,31,500. 8.40 to 8.45: 10 c. c. 8.45 to 8.55: 15 c. c. 9 P. M.: R. B.C.,5,085,000. W. B. C., 8,200. 9.16 to 9.40: 25 c. c., slowly. 9.45: R. B. C., 4,810,000; W.B.C.,6,600; 6,600. 10.45: R.B.C.,4,910,000; W.B.C.,8,000. 12.30: R,B.C.,4,550,000; W.B.C.,27,000; urine contained albumin. Next day: R. B. C., 5,320,000; W. B. C., 9,800.

Experiment XXVII.—5 P. M.: R. B. C., 5,360,000; W. B. C., 9,375. 5.30: R. B. C., 5,600,000; W. B. C., 5,000. 5.55 to 6.19: 10 c. c. horse's serum 48 hours old, injected slowly per jugular vein. 6.20: R. B. C., 5,160,000; W. B. C., 11,000. 6.25 to 6.47: 17 c. c. 6.50: R. B. C., 4,720,000; W. B. C., 12,000. 6.55: 5 c. c. 7 to 7.30: 15 c. c., slowly. 7.30: R. B. C., 4,080,000; W. B. C., 7,500. 8.30: R. B. C., 4,200,000; W. B. C., 20.000. 9.30: R. B. C., 4,150,000; W. B. C., 10,000. 11.30: R. B. C., 4,825,000; W. B. C., 18,000. Next day: R. B. C., 4,125,000; W. B. C., 25,000.

Experiment XXVIII (large rabbit).—3 P. M.: R. B. C., 5,800,000; W. B. C., 5, 250. 3.20: R. B. C., 5.700,000; W. B. C., 4,000. 5.45: Injection, subcutaneously 30 c. c. horse's serum 24 hours old. 8.15: R. B. C., 5,800,000; W. B. C., 6,700. 10.30: R. B. C. 5,820,000; W. B. C., 6,400. 1 A. M.: R. B. C., 5,720,000; W. B. C., 2,200. Next day, 10 A. M. R. B. C., 5,900,000; W. B. C., 10,000. 3 P. M.: R. B. C., 5,800,000; W. B. C., 5,000. 10 P. M.: R. B. C., 5,850,000; W. B. C., 8,500.

Experiment XXIX (small rabbit).—4 P. M.: R. B. C., 4,680,000; W. B. C., 7,500. 4.30: R. B. C., 4,960,000; W. B. C., 10,000. 5.15: Injection subcutaneously 20 c. c. horse's serum 1 day old. 8.15 P. M.: R. B. C., 4,680,000; W. B. C., 5,000. 10.30 P. M.: R. B. C., 5,240,000; W. B. C., 6,250. Next day, 1 A. M.: R. B. C., 5,080,000; W. B. C., 6,250. 10 A. M.: R. B. C., 6,040,000; W. B. C., 5,000. 3 P. M.: R. B. C., 5,600,000; W. B. C., 9,000; urine contained albumin.

From these experiments it will be seen that serum of the horse has no toxic effect upon rabbits. Although large quantities were injected directly into the veins of the rabbit (76 c. c. in one case and 47 c. c. in another), the number of corpuscles were not

reduced below four-fifths their normal quantity. It is probable that the dilution caused part of this reduction, for in the experiments in which horse serum was injected subcutaneously into rabbits there was no change in the number of corpuscles. There was no alteration in the number of leucocytes, but with intravenous injections there were fewer lymphocytes, while the multinuclear leucocytes were increased. With subcutaneous injections there was no alteration in the proportion. Albuminuria, but no hæmoglobinuria was produced.

Varieties of leucocytes, horse's serum injected into rabbits.

EXPERIMENT XXVI

	Normal.	8.40 P. M., one-half hour after first injection.	10.45 P. M., 76 c. c. had all been injected 1 hour before.	12.30 A. M.	Next day.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Lymphocytes	25	19	15	14.2	14
Large mononuclear	2	7	.5	1.5	4.2
Transitional	2	5	1	2	3.1
Eosinophiel	1	1	.75	.3	----------
Multinuclear	70	68	83	82	78.6

EXPERIMENT XXVII.

	Normal (1,000).	6.20 P. M., 10 c. c. injected.	6.50 P. M., 27 c. c. injected.	7.30., 47 c. c. injected.	11.30.	Next day.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Lymphocytes	23.4	26	26.5	15	7	9.1
Large mononuclear	2.2	2.6	2.5	1.5	1.3	1
Transitional	2.5	2.3	3.4	2	1.6	1.5
Eosinophile	----------	1.5	.6	----------	----------	.1
Multinuclear	71.3	67.6	67	81.5	90.1	87.4

EXPERIMENT XXIX.

	Normal.	10 P. M., 25 c. c. subcutaneously, 5 hours after injection.	10 A. M. next day.	10 P. M. next day.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Lymphocytes	22.8	23.4	26	30
Large mononuclear	1.9	1	1	1
Transitional	1.7	2.4	2.4	1.5
Eosinophile	.7	1.6	.4	----------
Multinuclear	73	71.6	70	67.5

CAT'S SERUM IN RABBITS.

Experiment XXX (large rabbit).—3.30: R. B. C., 5,625,000. 4: R. B. C., 5,850,000; W. B. C., 7,500. 4.45 to 5: Injected 10 c. c. cat's serum one day old, per jugular vein. 5.15: R. B. C., 5,140,000. 5.35: R. B. C., 5,100,000. 6: R. B. C., 5,500,000; no symptoms.

In this one experiment in which 10 c. c. cat's serum was injected intravenously into a rabbit, there was neither toxic or globulicidal action.

SHEEP'S SERUM IN CATS.

Experiment XXXI (medium-size cat).—3.30: R. B. C., 5,200,000; W. B. C., 29,000. 4: R. B. C., 5,125,000. 4.05 to 4.10: Injected per jugular vein, 20 c. c. sheep's serum 1 day old. 4.15: R. B. C, 5,020,000; W. B. C., 11,000. 4.35: R. B. C., 4,500,000; W. B C., 12,000. 5: R. B. C., 5,000,000; W. B. C., 12,000. No symptoms; cat killed.

In this one experiment, in which 20 c. c. of sheep's blood was injected into the vein of a cat, there was neither toxic or globulicidal action.

To recapitulate. Human serum injected into veins of rabbits was found most toxic and most actively globulicidal. When injected rapidly it causes death in a few minutes, the corpuscles falling to one-half or one-third their normal number. When injected slowly death comes on much later, the number of corpuscles sinking to one-fifth the normal. In these latter experiments there were convulsions, paralysis, and great disturbance of respiration, and finally death by respiratory failure; but in the former, death came on rapidly by cardiac failure and without the toxic symptoms.

With dogs, human serum has neither a toxic or globulicidal action.

With frogs, human serum is both toxic and globulicidal.

Dog's serum is toxic when injected rapidly into vein of rabbits. When injected slowly in some cases death comes on with slight diminution of red blood corpuscles while in others recovery occurs, even after as much as 30 c. c. has been injected, with but slight reduction in the number of corpuscles.

With frogs, dog's serum is toxic.

The serum from the horse is neither toxic or globulicidal to rabbits.

Cat's serum in rabbits is neither toxic or globulicidal.

Sheep's serum injected into the cat is neither toxic or globulicidal.

Heat destroys both the toxic and globulicidal action of human serum. Standing in a cool place for seven days did not cause the serum to lose its globulicidal action; but the toxicity was increased.

There was no constant alteration in the number of white blood corpuscles, but when the red corpuscles are destroyed there is also a paucity of leucocytes. When human serum or dog's serum was injected into rabbits, the number of lymphocytes was increased while the proportion of multinuclear leucocytes was decreased. Horse's serum injected into rabbits increases the multinuclear leucocytes and diminishes the lymphocytes.

From the fact that the serum of the dog injected into rabbits is toxic without having any globulicidal effect and also from the fact that human serum injected rapidly into the veins of rabbits causes death in a few minutes, before the corpuscles are reduced below one-third their normal, while the slow injection causes a reduction to one-fifth their normal before death, it seems probable that the toxicity of serum is not dependent upon its globulicidal action and rather indicates a multiplicity of poisonous substances in the serum. The fact that heating destroys both the toxic and globulicidal action shows their albuminous nature. Buchner has also found that diluting the serum with water causes the globulicidal action to disappear, but it reappears on the addition of sodium chloride. Maragliano* has found that in a number of diseases in man, in which the blood is altered, the globulicidal action is greatly increased, destroying not only the corpuscles of other species, but also those of healthy men. He further found that the haemoglobin was destroyed and did not remain in solution as when destroyed by other agents. He also noticed that the globulicidal action was greatest in the case containing the least sodium chloride in solution in the serum. When this salt was increased, the globulicidal property was lessened and the patient recovered.

From the experiments detailed in this paper it will be seen that the corpuscles of an animal are not destroyed by every foreign serum. The serum of man and of the dog, two flesh-eating animals, is toxic and globulicidal to rabbits, while the serum of the cat had no effect upon the rabbit. The serum of man had no effect upon the dog.

In studying the subject of transfusion it was found by Panum and by Poufick and others that sheep serum in large quantities is toxic to dogs.

Lamb's serum has been injected into human beings suffering from tuberculosis without any unpleasant result.

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* *Loc. cit.*

Rummo * has studied the toxicity of different serums, but my observations seem to show that the toxicity is greater than stated by him. He found the toxicity increased enormously in acute infectious diseases.

In those cases where death occurred from the injection of either human or canine serum, I never found a chicken-fat clot in the heart. The ventricles were distended, the left with fluid blood, while the right often contained a soft, non-adherent, very dark clot, such as is formed just in the agonic period.

DISCUSSION.

Dr. Hodge. I have been greatly interested in Dr. Carter's paper, but, unfortunately for this discussion, have not worked in this department of physiology. I am glad to say, however, that we have a member present who has worked extensively in the related field of the germicidal properties of blood and serum, and Dr. Beyer has kindly consented to open the discussion.

Dr. H. G. Beyer, U. S. Navy, discussing Dr. Carter's paper on the globulicidal action of certain blood serums when injected into different animals, asked whether Dr. Carter had taken into close consideration the relative proportion of leucocytes to the red globules, as well as the absolute number present of each. For, inasmuch as any error creeping into the count of the red in case of an increase of the leucocytes would give rise to errors being multiplied by as many times as 1 cubic millimeter is contained in 6 liters of blood. Dr. Carter stated that while the leucocytes of the different classes changed in number and in their relations to themselves, their relative proportion to the red globules had not changed, and throughout his experiments remained the same. Dr. Beyer was satisfied.

Dr. Macallum objected to the term "globulicidal." It would appear that Dr. Carter's results might be very well explained as due partly to physical and partly to physiological processes. It is well-known that the isotonic coëfficient of the red corpuscle of the animal is different from that of the red cell in another animal. When, therefore, the serum of one animal is injected into the blood of another the physical equilibrium is overthrown and red corpuscles disintegrate. This result, therefore, is a physical one. On the other hand, that serum of some animals when injected into those of another species, gives toxic effects seems to be definitely proved by the results of the experiments described by Dr. Carter. Dr. Macallum took exception to the view enunciated by Dr. Beyer, that observations tend to show that red cells originate partly from the white corpuscles. If the results of experiments of the last five years show anything at all, it is, that white cells never give origin to the red cells and, from the embryological point of view, the white cells never give origin to the red.

Dr. Beyer, continuing the discussion in answer to Prof. Macallum, stated that the literature within the period stated showed apparently, without doubt, that there are leucocytes that change into red corpuscles, namely, those that come from the bone marrow and a part of those coming from the spleen; those coming from the spleen are transformed into red partly within the spleen itself, partly after entering the blood current.

Dr. W. S. Carter said:

In reply to Dr. Beyer's question I would say that there was no alteration in the proportion of white and red blood corpuscles. With horse's serum in rabbits there was scarcely any alteration in the number of corpuscles of either kind, but there was a distinct change in the proportion of leucocytes. With dog's serum in rabbits there was scarcely any distinction of corpuscles, but when there was a distinction both kinds were affected so that there was change in the proportion of red and white

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* Trans. Tenth Internat. Med. Cong., Vol. II, p. 198.

corpuscles. In these there was a distinct alteration of the proportion of the different kinds of leucocytes. Human serum in rabbits caused rapid distruction of both kinds of corpuscles, there being no alteration in the proportion of white and red corpuscles. Here there was apparently an alteration in the proportion of leucocytes.

In reply to Dr. Macallum's remarks I would say that the term "globulicidal" seems a good term. It is used both by Daremberg and Buchner, and, as Buchner remarks, it is a property of the "half-living serum" and not a physical property. Certainly the corpuscles are greatly concerned in metabolism. There is a destruction of both red and white corpuscles, and under the miscroscope the changes of necrobiosis are seen in the white corpuscles when exposed to certain foreign serums. For these reasons it seems that "globulicidal" best describes the action of the serum.

THE EFFECT OF LESIONS OF CERTAIN PARTS OF THE BRAIN UPON THE HEAT PROCESSES.

By EDWARD T. REICHERT, M. D.,

Professor of Physiology, University Pennsylvania.

In an article on thermogenic centers, read before the last meeting of the American Society of Physiologists and subsequently published in the University Medical Magazine for March, I briefly reviewed the experimental work thus far published which seemed to bear directly upon the nerve centers specifically concerned in the production of heat, and reported a new series of investigations, showing the location of the automatic thermogenic centers. The chief conclusions arrived at were (1) that the automatic thermogenic centers are located in the spinal cord; (2) that the cruciate and Sylvian centers in the cortex cerebri are thermo-inhibitory; (3) that the caudate nuclei and medulla oblongata contain thermo-accelerator centers; (4) that no specific heat centers probably exist in the optic thalami; (5) that specific thermotaxic centers, i. e., centers having a common control over heat production and heat dissipation, do not exist.

A number of points in connection with that study obviously needed further investigation, as, for instance, the conflicting statements of White as opposed to those of all other recent investigators relative to the physiology of the brain cortex in connection with the heat mechanism; the assertion of Ott that injury of the white matter immediately in front of the caudate nuclei is followed by a marked rise of temperature; the conflicting beliefs regarding the existence of heat centers in the optic thalami; the effects of injuries of the cerebral peduncles upon the heat processes; the effects of injuries of the pons upon the heat processes; the effect of pyretic and antipyretic drugs upon the heat functions after injuries of certain of above parts. These, together with other suggestions of seemingly minor importance, lead me to begin several series of investigations.

In the present inquiry two classes of experiments were performed; in one, complete transverse sections of certain parts at the base of the brain were made, and in the other the same parts were punctured. Sections were made with the idea of cutting off the influences of higher from lower parts and punctures were made for the purpose of definite localization of heat centers, or bands of heat films. I have not attempted localization by means of the injection of caustic solutions because such a method is generally far inferior to puncturing. Unfortunately, I have not been able to complete this work in time to report the results in full and in the present communication I can only offer the records of a series of sections.

In the study of the effects of lesions of the nerve centers upon the heat mechanism it is necessary to keep in view the fact that injury of almost any part of the cerebro-spinal axis may be followed by a more or less marked rise of temperature,

which may continue for hours, or even days, and which is particularly likely to occur, if the injury is complicated by much hæmorrhage, the pressure of a clot, shock, laceration of the tissues, etc. Besides this, a fertile source of error may exist in the marked and unaccountable fluctuations which occur under perfectly normal circumstances in the bodily temperature of rabbits, cats, guinea pigs, and dogs—the animals almost solely employed in this sort of investigation. The heat processes in dogs seem to be of greater stability than those in the other animals referred to, and on that account chiefly I have chosen them for this research. The mere fact that the heat mechanism may be materially influenced by injuries of any part of the nerve centers renders it evident that no portion of the brain or spinal cord should be concluded to be specifically concerned in the heat processes unless the phenomena produced by operations upon it are distinctly more marked than those which are observed when other but different parts are affected and unless the results are fairly constant and positive and the lesions properly localized.

In some of the experiments in the present series, observations were made only of the temperature; in others, records of temperature, circulation, respiration, and motor reflexes were obtained, while in others the method was calorimetrical. In all of the experiments strong healthy dogs were used. The technique of the operations was in all cases the same, unless specifically noted. The animals were anæsthetized with ether, chloroform, or a mixture of both; a small trephine opening was made in the side of the skull opposite to and on a level with the upper surface of the structures to be cut; the membranes were punctured; a slightly bent probe, 1 mm. thick and 2 mm. wide, was inserted horizontally and pushed across the brain until the skull on the opposite side was reached, and then with a downward sweeping movement all the cerebral mass below the probe was completely severed. A certain amount of hæmorrhage always occurred, but this was always very slight, and by properly inclining the head for a few minutes immediately after the operation drainage was facilitated and the pressure from a clot in a large measure prevented. Temperatures were seldom taken before the operation because the struggles of the animal, as well as the direct influences of the anæsthetic, so affect the heat processes that the record as a standard is more or less of a fictitious value. By means of sensitive thermometers, temperatures were obtained within three to five minutes after the section. With the exception of the calorimetrical experiments the thermometer was retained in the rectum throughout the entire periods of observation.

The experiments may be divided into six classes, distinguishable by the region of section (1) the frontal lobes just anterior to the caudate nuclei; (2) the corpora striata; (3) the optic thalami; (4) the crura cerebri; (5) the pons.

For many reasons it would have been desirable to have included a number of experiments upon the cortical heat centers of Eulenberg and Landois, and of Ott, especially so since White, in a recent communication (Journal of Physiology, XII, 1891, p. 233), gives results which lead him to reach conclusions in opposition to those of all other recent investigators upon these parts. White believes that lesions of the cruciate centers (Eulenberg and Landois) do not, or but slightly, alter rectal temperature. Regarding the Sylvian center (Ott), he concludes that its injury may cause irregular rises of temperature, which are quickly produced and last but for a short time; sometimes several rises and falls occur after one operation. He was induced to believe, considering the irregular variations and rapid character of the changes of temperature following these lesions, that certain parts are concerned in maintaining the balance between heat production and heat dissipation; in other words, of the nature of the hypothetical thermotaxic centers. White's results and conclusions do not, however, seem to be in entire accord. Thus, in his experiments on the cruciate region a rise of temperature occurred in every instance after the operation, varying from 0.4° to 2.8° F.; and in those on the Sylvian areas, in 18 out of 21 there was a rise—in 6 of less than 1°, in 3 between 1° and 2°, in 9 from 2° to less than 3°, and in 3 from 3° to 4°; the average rise being 1.62° and the greatest 3.6°.

t seems, therefore, that White's results are rather in accord than conflicting with hose of other investigations. There is, consequently, at the present time no suffi-ient evidence to weaken the belief that there are specific heat centers in the cruci-te and Sylvian regions, and that both are thermo-inhibitory.

My experiments show that sections of the basal parts of the brain, even though he animals are thoroughly anæsthetized, generally severely affect the thermal, irculatory, respiratory, and motor reflex functions, and that, in a majority of nstances, the shock to the respiratory centers is so great that the animals succumb within a few minutes to failure of the respiratory movements. If, however, arti-icial respiration is maintained the immediate effects of the shock pass off and, within a period varying from less than a minute to an hour or more (usually from ive to ten minutes), automatic respiration is regained. The respiratory centers enerally show for hours that their operations are disturbed, as is evident in irregu-arities in the depth and frequency of the respiratory movements, which frequently ccur throughout the successive hours of observation. Indeed, it is not uncommon or spontaneous respiration to cease and after a time to be resumed, only again to ease and be resumed, and so on many times during the four or six hours after the ection. As a rule, it seems that the nearer the sections are to the medulla oblongata he more profound and lasting the effects upon the respiratory centers. The circu-ation is always sooner or later materially affected. Sometimes the heart's action, nmediately after the operation, is completely inhibited, the arrest usually lasting or but a few seconds, although in one experiment it was for thirty-seven seconds. have never seen death result from permanent inhibition. That this inhibition s due to influences exerted through the inhibitory centers is evident in the fact hat it was never present after section of the pneumogastric nerves. In some xperiments these nerves were cut before the brain section was made, and in thers during the existence of the inhibition. In the former, inhibition did not ccur; and in the latter, it at once ceased.

In many of the experiments, sudden changes in the rapidity and force of the eart's beat occurred during the successive hours of observation, and without bvious cause. Sometimes within a second or two the heart's action would become normously altered, thus in one case it fell from 264 to 192 beats per minute within few seconds; shortly after this it suddenly increased from 153 to 240. The arterial ressure is variously affected, generally showing a tendency to slight increase dur-ng the early period of the experiment and to a decrease later. But there is a great ack of uniformity. Owing to the sensibility of the respiratory centers to the injury o the parts subjected to section, it was my practice, after anæsthetization, to insert tracheal tube, and as soon as any sign of failure of respiratory movements occurred, o begin artificial respiration, maintaining this until spontaneous respiration eturned with sufficient strength to carry on the function.

After these operations the dogs usually remained in a condition of stupor and eldom lived for more than six or eight hours, many of them succumbing in less ime and some living from two to three days.

(1) LESIONS OF THE FRONTAL LOBES JUST ANTERIOR TO THE CAUDATE NUCLEI.

Ott states (Therapeutic Gazette, September 15, 1887), apparently from the results f a single experiment on a rabbit, that transverse section of the white matter 1 mm. anterior to the ends of the caudate nuclei is followed by a rapid rise of tem-erature, which lasts until the third day. This, he also states, is the most anterior art of the brain, which will give a marked rise of temperature when injured. On he other hand, the experiments of Aronsohn and Sachs (Pfluger's Archiv f. Physi-logie, LVI, S. 237), and White (Journal of Physiology, XI, 1891, and XII, 1891), lead o the belief that injury of this portion of the brain is not followed by a rise of emperature.

In two experiments in which I made section just in front of the ends of the caudate nuclei, barely escaping them, the temperature fell in both. Records were made of temperature, pulse, arterial pressure, and respiration, which will be found in the following tables. In experiment 1 the section was less than 1 mm. from the nuclei, and in experiment 2 just 1 mm. in front of them. While both circulation and respiration were materially affected in both there is no apparent connection between the effects on them and the fall of temperature. If, however, the section involves even the tips of the nuclei the effects on temperature are very different, as are illustrated in experiments 3, 9, and 10, in which from 1 to 2 mm. were cut off, in every one of which a rise of temperature was recorded. The evidence, therefore, seems to point conclusively to the belief that the rise of temperature noted in Ott's experiment was due either to injury to the ends of the caudate nuclei or was an exceptional result.

(2) LESIONS OF THE CORPORA STRIATA.

The experiments of Ott (Journal Nervous Diseases, April, 1884), Aronsohn and Sachs (*loc. cit.*), Girard (*Archiv. de Physiologie*, VIII, 1886, p. 281), Baginsky and Lehmann (Virchow's Archiv, CVI, 1886, S. 258), and White (*loc. cit.*) all indicate that lesions of the striated bodies are generally followed by a marked increase of bodily temperature, and some of the observations show that this increase is due to increased heat production consequently leading to the belief that these structures contain thermo-accelerator centers. The most extensive of the above investigations is by White embracing 23 experiments in his first paper and 4 in his second. In 3 of the 27 no rise occurred, and in 2 there was a fall; in the remaining 24 the temperature reached as high as from 104° to 106.8°; in 7 it was 106°, or over.

In my own investigations section was made through these bodies in 12 experiments, in 6 of which calorimetrical methods were employed. In the first 6 the sections were made at the following levels from the anterior extremities of the caudate nuclei: Experiment 3, 2 mm.; experiment 4, 5 mm.; experiment 5, 6 mm.; experiment 6, 9 mm.; and in experiments 7 and 8, 12 mm. A rise of temperature occurred in every experiment, although the alterations were by no means uniform in general characters or in degree. The rises were, respectively, 0.36°, 0.98°, 4.37°, 3.4°, 3.08°, and 2.2°. Possibly in experiment 8 the rise might have been greater had not 3 grams of phenocoll hydrochlorate been intravenously injected, although this is not probable judging from the results of other experiments in which antipyretics were administered.

In experiment 3 the increase of temperature passed away within twenty-five minutes after the section, and was followed by a marked fall, which progressed until the end of three hours, showing a decrease of 2°. In experiments 4 and 6 there was a primary fall followed by a rise; in the former the rise was followed by a fall, and in the latter it continued to increase until death. In experiment 5 the rise set in at once and steadily continued until death, the temperature increasing within four hours from 39.68° to 44.05°. In experiment 7 there was a slight primary rise; then a slight decline, but not to the normal; then a marked rise followed by a fall. In experiment 8 the temperature rose steadily for one and three-quarter hours, and then slightly declined. What influence the injection of the phenocoll had is not positive, although as before stated, it is doubtful if it at all affected the results. The average rise of temperature in the 6 experiments was 2.39°, the minimum being 0.36°, and the maximum 4.37°. In the remaining 6 experiments the hourly records of bodily temperature are, of course, insufficient to show the maximum and minimum fluctuations, but in every case an increase was noted, varying from 0.34° to 4.1°. Doubtless, with but a single exception, the rise was materially greater. The calorimeter and methods employed were described by me in the University Medical Magazine for January, 1890

The sections were at the following levels from the anterior margins of the caudate nuclei: Experiment 9, 1 mm.; experiment 10, 2 mm.; experiment 11, 6 mm.; experiment 12, 8 mm.; experiment 13, 10 mm.; and experiment 14, 14 mm.

A study of these results shows as important facts (1) that there is in the different experiments no general uniformity in the alterations in heat production, heat dissipation, and bodily temperature; (2) that both heat production and heat dissipation are more or less independently affected, although the alterations in the latter are largely dependent upon those in the former; (3) that in every experiment there occurred at some period an increase of bodily temperature; (4) that the rise of temperature was due to an increase of heat production.

In 4 experiments (Nos. 9, 11, 12, and 13) heat production was increased during the first hour after the section; heat dissipation was also increased in each, but, with a single exception, to a far less degree than heat production, thus indicating that the alterations in dissipation were of a compensatory nature. In 2 experiments (Nos. 10 and 14) both heat production and heat dissipation were diminished during this period, heat production being more affected than dissipation, this again indicating that the alterations in dissipation were dependent. During the subsequent hours the relations between the curves of production and dissipation were of an uncertain character and indicate that during this period the alterations in dissipation were in a measure independent of those in heat production.

In 2 experiments (Nos. 11 and 13) the maximum rise of temperature was noted at the end of the first hour, the increases being respectively 0.82° and 1.88°; in 1 (No. 9) the highest temperature was noted at the end of the third hour, the increase amounting to 0.54°; in 2 experiments (Nos. 10 and 14) the maximum was noted at the end of the fourth hour, the rises being 0.48° and 2.19°, respectively; and in experiment 12 the increase amounted to 3.43°, recorded at the end of the fifth hour, the average time of the occurrence of the maximum increase being two hours and fifty-three minutes after the section.

Therefore, in every one of 12 experiments in which the corpora striata were cut, the level of the section varying from 1 to 14 mm. from the anterior extremities of the caudate nuclei, an increase of temperature occurred, the minimum being 0.36° and the maximum 4.37°. In the first six of the series, in which temperature records were frequently taken, and in which these records are more valuable for showing the maximum effects, the average rise was 2.39°.

A careful comparison of the records of the different experiments leads to the belief that the temperature is most profoundly affected when the section was located from 6 to 12 mm. from the anterior extremities of the caudate nuclei.

(3) LESIONS OF THE OPTIC THALAMI.

Both Ott (*loc. cit.*) and Baculo (La Riforma Medica, 1890, pp. 1568 and 1574) state that lesions of the optic thalami cause a rise of temperature, and believe that these ganglia contain heat centers. Ott's experiments were made by puncture or section, while those of Baculo were by the injection of bismarck brown and bichromate of potash, etc. White (*loc. cit.*), however, has obtained different results. In his first paper he reports 9 experiments made by puncture, in every one of which there occurred a rise of temperature; but in his second contribution, as a result of further and more cautious study, he reaches the conclusion that the thalami possess no power to cause an increase of temperature, and that when they have apparently done so, it has been owing to involvement of the corpus striatum.

My own experiments seem to be in accord with White's conclusions. In 2 experiments, in both of which the sections were in the posterior half of the thalami, the striate bodies not being injured, a slight but transient rise of temperature occurred, which was followed by a marked fall.

In experiment 15 the section was through the middle of the ganglia; the temperature rose only 0.14°, and then rapidly fell. In experiment 16 the temperature increased during the first eleven minutes 0.1° and then declined. In this experiment the section was 3 mm. from the posterior extremities of the thalami.

In one calorimetrical experiment, in which the section was 4 mm. from the posterior extremities of the ganglia, a decided fall of temperature, heat production, and heat dissipation was noted. Heat production was affected more than heat dissipation, so that the fall of temperature was doubtless due to a diminution of heat production.

The results of these three experiments are in striking contrast with those in which the striated bodies were cut.

(4) LESIONS OF THE CRURA CEREBRI.

There are extremely few experiments on record in which the temperature alterations were studied after section of the cerebral peduncles. Pflüger (Pflüger's Archiv. f. Physiologie, XII, 282, 333) states that after section of the crura behind the corpora quadrigemina, the temperature is sometimes increased and sometimes diminished. In one experiment by Wood (Fever; A Study in Morbid and Normal Physiology, Smithsonian Contributions to Knowledge, No. 357, 1880), partial section was followed by a rise. Fleishmann (Wien. Med. Woch. 1871, Nos. 6, 7, 8, 9.) found a diminution of 3° F. within a half hour. In 2 experiments by White (*loc. cit.*), a marked rise was noted in each, amounting to 3.4° and 2.2° F., respectively.°

Of 20 experiments which I performed, in which special study was made of the temperature, the results of which will be found condensed in the following table, a rise was recorded in 16 and a fall in 4. The increase varied from 0.04° to 3.64°. In 12 it ranged from 0.04° to 84°, and in 4 from 1.2° to 3.64°. In 10 out of the 16 it was very transient. The region of section does not seem to exert any special influence; in experiments 18, 19, 20, and 25, the sections were close to the thalami, and the rises were 0.04°, 0.14°, 0.25°, and 2.94°, respectively; In experiments 24, 32, and 33, the sections were in the middle, and the rises amounted to 1.2°, 0.12°, and 0.4°, respectively; and in experiments 21, 22, 23, 26, 27, 28, 29, 30, 31, 34, 35, 36, and 37, the sections were all within 3 mm. of the pons, the rises being 0.84°, 0.12°, 0.08°, 0.65°, 0.54°, 0.55°, 1.3°, 0.07°, and 3.64°; in experiments 34, 35, 36, and 37, the temperature fell from the first.

Besides these, 28 experiments were performed by means of the calorimeter. In 5 (experiments 39, 40, 41, 42, and 44) the sections were within 4 mm. of the pons; in experiment 43 it was midway between the pons and optic thalami; and in experiments 45 and 46 it was close to the thalami. In 4 of the 8 a slight, transient rise of temperature occurred immediately after the section, which was followed in every instance by a profound fall. In the other 4 a fall set in immediately after the operation. A study of calorimetrical records renders it evident that the fall of temperature was due to diminished heat production.

(5) LESIONS OF THE PONS.

Tscheschichin (Dw-Bois Reymond's Archiv. für Physiologie, 1866, s.) in a single experiment records that division of the medulla oblongata from the pons was followed at once by a marked increase of bodily temperature. Bruck and Günter (Pflüger's Archiv. f. Physiologie, III, 1870, s. 578) in 23 experiments in which the pons was severed at its junction with the medulla, or in which it was punctured, state that in 11 an increase of temperature occurred, and in 12 a diminution. In 11 experiments by Ward (*loc. cit.*), in which partial or complete section was made, an increase occurred in 8 and a decrease in 3. In 2 of the former the rise amounted to 3.25° and 4.88°, respectively. Of 7 experiments (Nos. 47 to 53 inclusive) in which I made section at this point, in 6 the temperature was increased, and in 1 it was diminished. Two of the experiments were calorimetrical. In experiment 47 the animal lived for less than one hour, and the temperature fell steadily from the time of the section. In experiments 48, 49, 50, and 51, the rises were, respectively, 3.48°, 0.27°, 2.87°, and 4.34°, an average of 2.74°. In the two calorimetrical experiments

(Nos. 52 and 53) the maximum increases were 0.61° and 0.76°, although the figures doubtless do not represent the full degrees of actions. The results of the latter experiments show clearly that the elevation of temperature in this series, as in the others in which this change was noted, was due to an increase of heat production.

In conclusion, an analysis of the results of those experiments of the different series in which the temperature alterations were specially considered, gives the following data:

	Section anterior to striated bodies.	Section of striated bodies.	Section of optic thal.	Section of crura cerebri.	Section of pons.
Number of experiments	2	6	2	16	5
Average duration of observation	2 hrs. 50 mins.	3 hrs. 43 mins.	2 hrs. 45 mins.	2 hrs. 34 mins.	3 hrs. 19 mins.
Average rise of temperature	0	2.39°	0.12°	0.8°	2.74°
Average time of occurrence of maximum rise of temperature	0	2 hrs. 53 mins.	8½ mins.	1 hr. 20 mins.	4 hrs.

By comparison and direct results, these figures clearly indicate that the striated bodies and pons are in some important way connected with the heat mechanism, either of the nature of nerve centers or nerve tracts; and, moreover, the fact that the increase of temperature is due to increased thermogenesis, and this to excitation and not loss of inhibition, leads inevitably to the belief that the formation is thermo-accelerator.

It is obvious that much work remains to be done before we are in a position to definitely state the meanings of the records of these important experiments, but the records, as far as they go, fully substantiate the claims made by me in a recent communication, to the effect of the locations and functions of specific heat centers.

THE RELATION OF THE NERVOUS SYSTEM TO HEAT PRODUCTION.

By ISAAC OTT, M. D.

In the Journal of Nervous Diseases I have classified the centers concerned in heat regulation as thermotaxic, whether concerned with thermogenesis, thermolysis, or thermo-inhibition. In some experiments just made with atropine it was found to act upon the cerebral thermotaxic centers and not on the spinal. It occurred to me that perhaps the heat was nearly all generated in the tissues. To determine this, it would be necessary to remove so much of the nervous system as possible and then determine the amount of heat produced. Cats were selected for this purpose. They were put into the calorimeter for two hours, when they were removed, etherized, and portions of the spinal cord destroyed. The calorimeter employed was the one improved by me, and whose error is only 5.4 per cent. After the animal was under the ether an opening was made into the vertebral canal in the upper dorsal region and the cord destroyed downward by means of a stiff wire as far as the lumbar vertebræ, where a second opening was made in the vertebral canal and the remainder of the cord destroyed. Then the animal was immediately returned to the calorimeter and the heat production studied for four more hours. After this he was killed with chloroform. It was found that sections below the fifth dorsal were nearly always followed by recovery; if above, near the last cervical vertebra, there was often arrest of the heart, and death. It was found that after sections above the fifth dorsal that the heat produced fell to nearly 1 or 2 units, but afterwards rose to about one-third to one-half of the normal output (experiment 1). If, however, the section was just at

the fifth dorsal, then nearly always the heat production remained but little below the normal amount (experiment 2). In one case (experiment 3) it exceeded the normal amount. Eleven experiments were made and they confirmed the preceding statements. The inquiry now arises, how are they to be explained? It is known if you divide the spinal cord between the fifth and sixth dorsal nerves, that is, where the splanchnic fibres divide from the cord, then the blood vessels of the skin and of the abdomen dilate and the blood-pressure falls greatly. If the section is made above the level of the second dorsal nerve, then in addition to the above vaso-motor paralysis there is a dilation of the vessels of the face and head which still further reduces the arterial tension. The cardiac accelerator nerves also leave the spinal cord by the second and third dorsal nerves and possibly to some extent by the fourth and fifth. While the vaso-constrictor centers of the body are in the dorsal cord, the vaso-dilators centers are spread throughout the cord.

When I destroy the cord below the fifth dorsal vertebra, I cut off vaso-constrictors, the splanchnics, and also annihilate the vaso-dilators, mainly going to the muscles below this point. This section causes a loss of muscular tonus and a great fall of arterial tension. If I destroy the cord about the first or second dorsal, then all the vaso-constrictors are destroyed and nearly all the vaso-dilators. The animals who died seemed to be shocked, probably by the reflex cardiac inhibition and partly by the great vaso-motor paralysis. In cats I made some blood-pressure experiments, and found that the above-mentioned sections and destructions of the cord greatly reduced the blood-pressure. Now, it seems to me, that the spinal thermogenic centers play but a small part in the heat production of these experiments. In an animal, after death, I made a transverse section of the whole body at the fifth dorsal vertebra, and the weight of the body anterior to this section was 3 pounds, while the body weight posterior to the division was a little over 5 pounds. In this case there could be no spinal thermogenic centers connected with the posterior part of the body, hence we can only have their effect upon the anterior part of the body—that is, the 3 pounds or three-eighths—while the five-eighths have only the tissue heat without any nervous action. Now, if we assume for the sake of argument that the heat produced after a section at the fifth dorsal is greatly due to spinal centers, then we must assume that the normal three-eighths of the body can produce as much heat as the normal eight-eighths of the body with an intact nervous system. This, to my view, is an absurdity. It seems to me much more rational to assume that the heat is nearly all produced in the tissues of the body and that the spinal thermogenic centers are of small value. That after the animal is greatly shocked by the section above the fifth dorsal it is easily understood that thermogenesis is greatly arrested. Admitting these facts, it is readily seen that the heat is mainly produced in the tissues and that the whole nervous system concerned in heat regulation is thermotaxic. If the temperature falls below 98.4° F., then impulses are sent by the cerebral centers to the spinal centers and more heat is generated. If the temperature is above 98.4° F., then the thermo-inhibitory centers of the cortex act or the tuber cinereum may be stirred up, and thermolysis be increased by augumenting the rate of respiration.

Dr. B. Baculo, of Naples, holds that the thermo-inhibitory centers act directly upon the basal thermogenic centers. While I have published experiments supporting this view, I think there is little doubt but that they also act directly upon the spinal thermogenic centers.

Dr. E. T. Reichert believes the spinal thermogenic centers to be of a high value, and played upon by cerebral centers, like the heart is played upon by the cerebral nerves. But these experiments show that the cerebral centers are of high value and the spinal thermogenic, *per se*, are of little value.

Dr. Baculo, of Naples, noted an increase of temperature after the injection of an irritant into the corpora quadrigemina. Baculo believes these bodies contain thermogenic centers like the tuber cinereum of the midbrain. The experiments in this

paper show that the arterial tension can be greatly lowered and heat production not be affected. In a previous paper I explained this rise of temperature after injury of the corpora quadrigemina as due to lessened tension and changed rate of respiration, but these spinal experiments have changed my mind. What the correct explanation is of this rise after an injury to the corpora quadrigemina remains to be worked out. That the tuber cinereum contains thermogenic centers is shown by the experiment where, with a fine dental drill, I punctured the tuber through the mouth, and obtained a temperature of 109° F. It should be remembered that what I have described as the thalamic heat center and the heat center about Schiff's expiration crying center, as well as the thermo-polypnœic center are all seated in the tuber cinereum. One of the most certain signs that you have punctured the tuber is the accelerated respiration, accompanied with a considerable and rapid rise of temperature. In puncturing through the mouth the fibre theory of some writers is demollished, as you injure no fibres in this operation.

That transverse sections in front of the caudate nucleus, or of the caudate nucleus itself, producing a rise of temperature and increased heat production, will show the presence of heat centers is conceded; but posterior to the corpus striatum no transverse section, even if accompanied with rise of temperature and increased heat production, will localize any heat center in the pons or medulla, as you have removed part of the heat-regulating apparatus anterior to the section, and very naturally the temperature rises and heat production is increased. It is only by well-localized punctures into gray matter, producing considerable rise of temperature and augmentation of heat production, that you can infer the presence of a thermogenic center at the base of the brain. That injury of the crura will cause a rise of temperature is true, but here you may, by puncture, injure both thermo-inhibitory and thermogenic fibers, so that no localization of a thermogenic center can be inferred.

It seems to me that in the cortex the cruciate center of Eulenberg and Landois, and the Sylvian, are thermo-inhibitory; that the basal thermogenic centers are located (1) in the caudate nucleus; (2) in the gray matter beneath and in front of the corpus striatum; (3) in the tuber cinereum, and that these centers act upon the tissues through spinal centers when the metabolism needs to be accelerated or retarded in activity, to develop the amount of heat necessary to keep the temperature at 98.4° F., and this is an act of thermotaxis. Therefore I believe the function of all these centers, thermogenic and thermolytic, to be heat regulating or thermotaxic.

EXPERIMENT I.

[Cat; weight, 3.34 pounds; section of cord at seventh cervical and destruction below this point.]

	H. P.	H. D.	R. T.	
			Beginning of hour.	Ending of hour.
First period before section	30.88	30.34	102.3	102.8
Second period before section	22.35	22.35	102.8	102.8
First period after section	1.36	19.03	96.6	90.2
Second period after section	10.54	13.34	90.2	89
Third period after section	12.42	12.96	89	87
Fourth period after section	92.1	11.93	87	86
Fifth period after section	10.53	13.57	86	84.9

EXPERIMENT II.

[Cat; weight, 7.28 pounds; section of cord at fifth dorsal and destruction of cord below this point.]

First period before section	24.99	27.89	101.1	100.5
Second period before section	28.26	32.25	100.5	99.8
First period after section	20.56	26.86	99.5	98.4
Second period after section	26.44	31.42	98.4	97.5
Third period after section	22.38	24.04	97.5	97.2
Fourth period after section	17.03	22.75	97.2	96.2

EXPERIMENT III.

[Cat; weight, 5.52 pounds; section at fifth dorsal and destruction of cord below this point.]

	H. P.	H. D.	R. T.	
			Beginning of hour.	Ending of hour.
First period before section	23.53	26.68	104.6	103.9
Second period before section	23.53	26.68	103.9	103.2
First period after section	26.34	32.70	103	101.6
Second period after section	32	34.73	101.6	101
Third period after section	22.33	25.06	101	100.4
Fourth period after section	25.49	24.94	100.4	100.5

EXPERIMENT IV.

[Cat; weight, 4.68 pounds; section of cord at fifth dorsal and destruction of cord below this point.]

First period before section	27.36	28.81	101.2	101.6
First period before section	28.90	29.77	101.6	101.4
First period after section	24.20	26.10	96.5	96.2
First period after section	25.23	24.46	96	96.2
First period after section	20.20	22.85	95.2	95.5
First period after section	24.96	26.80	95.5	95
First period after section	24.28	28.29	95	94

DISCUSSION.

Dr. Beyer said that there was no room for further doubt of the existence of specific heat-producing, heat-dissipating, and heat-regulating centers in the brain as well as in the spinal cord. In the case of the heart and its accelerating and inhibitory centers in the medulla, we have quite an analogous condition only, that work is produced by these cardiac centers which are definitely located, and in the case of the heat centers heat is produced under normal condition, which is only another form of the same energy. In one case we obtain work by the peculiarity of the connection of these centers with peripheral organs; in the other case we attain heat for similar reasons.

Dr. Macallum observed that in experiments on the central nervous system much more happens than what appears on the surface, as is shown by the condition called "shock." This complicates the results obtained, although the experiments of Ott, Reichert, and others show distinctly that there are "centers" whose function is that of controlling the production and dissipation of heat. All who have studied the history of our knowledge of the vaso-motor centers will remember the discussions on the question of the existence of subsidiary vaso-motor centers in the cord, and even along the blood vessels. Many of the results which have been obtained in those experiments have been due to "shock." If we bear in mind, then, that a similar condition occurring after experiments on the central nervous system should manifest itself by some results which possibly have been attributed to influencing the central heat "centers" one may, for all this, well believe in the existence of such centers, although we may further allow that their delimitation and localization have not been exactly determined.

HOW DOES ATROPINE ELEVATE THE TEMPERATURE OF THE BODY?

By ISAAC OTT, M. D.

If atropine is given to an animal it will cause a rise of temperature varying from 1.5° to 6.8° F., provided the temperature of the ambient air is elevated. If, during the elevation of temperature, the sciatic is electrically irritated, a greater rise ensues. This rise after sciatic irritation is not sudden as normally takes place, but rises gradually and continues after the irritation for two hours, after which it gradually falls. It was found that while the temperature was rising the arterial tension was falling. When it was determined by the calorimeter, it was found that the increase of temperature was accompanied by an increased production and augmented dissipation of heat. I have heretofore, on account of the spinal stimulant action of atropine, inferred that the elevation of the temperature was due to spinal stimulation. To experimentally determine the seat of action I have used cats which are well suited to show the elevation of temperature. Thirteen experiments were performed. When the cord was cut at the atlas and atropine injected per jugular there was no rise of temperature. Several repeated experiments demonstrated that the rise was not spinal.

The next experiment was made after a transverse section, just in front of the medulla oblongata, the carotids being previously ligated; then a rise of temperature ensued, after the use of atropine, of about 1°. But normally a rise of temperature ensues after section in front of the medulla, because the great regulating centers of the brain have been cut off. How are we now to differentiate between the normal rise and that rise after the drug? After the atropine the rise is only 1°, but when the animal's nervous system is intact the rise is often 6.8° F. I have also made some sections in front of the pons varolii and given atropine. Here we also have a rise of temperature without atropine. With the atropine the highest rise was 2.2° F., after section in front of the pons, which is not more than would be expected normally. After careful consideration of the results, it seems to me difficult to speak accurately as to the cerebral center affected. The slight rise of temperature after puncture of the medulla or pons varolii in the rabbit have not led me to believe in the existence of thermogenic centers in these bodies. Until we have definitely determined the existence of heat centers in these organs it seems to me useless to assume that atropine acts upon them. Although not directly connected with this subject, yet I hope it will not be amiss to speak of the value of atropine in shock, as in the preceding paper I have demonstrated that during the first hour of shock heat production is nearly zero, and as atropine is an augmentor of heat production we have an additional proof of what is practically known, that atropine is of great value in shock. Cocaine is also an accelerator of heat production and would without doubt be of great utility.

EXPERIMENT I.

[Cat; tracheotomy; spinal cord cut just below atlas.]

	R. T.	A. T.		R. T.	A. T.
P. M.			P. M.		
2.55	103	90	3.20 ($\frac{1}{20}$ gr. of atropine per jugular)		
3.00	102		3.34	101	
3.05 ($\frac{1}{20}$ gr. of atropine per jugular)			4.03	100.4	
3.08	101.8	90	4.05 ($\frac{1}{20}$ gr. of atropine per jugular)	100.4	
3.25	101		4.45	99	

EXPERIMENT II.

[Cat; tracheotomy; spinal cord cut at second cervical vertebra.]

P. M.			P. M.		
1.15	103	98	2.26	104.5	
1.40	105.2		2.33 ($\frac{1}{40}$ gr. of atropine)	103.6	
1.58	103.6		2.43	102.7	
2.07 ($\frac{1}{20}$ gr. of atropine per jugular)			2.53	102.7	
2.20	104.5		3.23	100.1	

EXPERIMENT III.

[Cat; carotids ligated; tracheotomy; transverse section of brain just in front of medulla oblongata.]

	R. T.	A. T.		R. T.	A. T.
P. M.			P. M.		
2.53	103.4	81	3.27	103.2	.....
2.54 ($\frac{1}{20}$ gr. atropine per jugular)	.....	.....	3.37	102.1	.....
3.00	103.6	82	3.47	102.1	.....
3.11	104.2	.....	4.15	100.6	.....
3.19	103.8	82	4.33	100.1	.....
3.20 ($\frac{1}{20}$ gr. atropine per jugular)	.....	.....	4.55	99	.....

EXPERIMENT IV.

[Cat; carotids ligated; tracheotomy; section just in front of medulla oblongata.]

A. M.			A. M.		
10.17	104.6	90	11.07	105.2	.....
10.18 ($\frac{1}{10}$ gr. of atropine per jugular)	.....	.....	11.18	104.6	96
10.22	104.7	92	11.19 ($\frac{1}{10}$ gr. per jugular)	.....	.....
10.27	105.1	94	11.25	104	.....
10.33	104.8	.....	11.30	103.4	.....
10.44	105	95	11.35	103.5	96
10.57	104.9	.....			

EXPERIMENT V.

[Cat; carotids ligated; tracheotomy; transverse section of brain just in front of medulla oblongata.]

P. M.			P. M.		
2.00 (before section)	102	80	2.45	103.2	.....
2.25 (after section)	103.1	80	2.54	103.2*	81
2.34	103	.....			

EXPERIMENT VI.

[Cat; carotids ligated; tracheotomy; transverse section of brain just in front of medulla oblongata.]

A. M.			A. M.		
9.50	104.3	90	10.13	104.6	.....
9.57	103.8	.....	10.17	104.6	90
10.03	103.8	.....			

EXPERIMENT VII

[Cat; carotids ligated; tracheotomy; transverse section at anterior edge of pons varolii.]

A. M.			A. M.		
9.28 (before section)	102.4	75	10.37	100.4	86
9.37 (after section)	101.6	.....	10.43	100.3	.....
10.24	100.4	83	11.10	100.7	90
10.31	100.2	85	11.30	100.8	88
10.32 ($\frac{1}{10}$ gr. atropine per jugular)	.....	.....	11.40	100.5	86

EXPERIMENT VIII.

[Cat; carotids ligated; tracheotomy; transverse section at anterior edge of the pons varolii.]

P. M.			P. M.		
1.30	102	97	2.35	103.2	92
2.13	102.2	97	2.44	103.2	.....
2.20	102.6	95	2.53	104.2	90
2.27	102.8	94	3.20	105	90
2.28 ($\frac{1}{10}$ gr. atropine per jugular)	.....	.....	3.27	105	.....
2.30	102.8	93	3.30	105	94

NOUVELLES RECHERCHES SUR LES CENTRES THERMIQUES AU SUJET DE LA THERMOGÉNÉSIE THERMODYNAMIQUE.

Par le Dr. B. BACULO.

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GÉNÉRALITÉ SUR LA THERMOGÉNÉSIE.

Les manifestations thermiques sont liées aux phénomènes bio-chimiques qui se produisent dans la texture intime des tissus. L'influence dinamogène du systeme nerveux, qui est le premier facteur dans le mécanisme de la régulation de la chaleur, est souveraine sur ces phénomènes.

La température des organismes s'élève sans cesse selon le progrès des pécilothermes aux oméothermes; dans ces derniers il y a la régulation de la chaleur. Cette fonction n'apparait dans les organismes animaux si le système nerveux n'a pas atteint une perfection, soit dans l'aggrégation des éléments istogénétiques, soit dans sa structure intime.

Tout cela est bien clair en considérant le développement du système nerveux dans les pécilothermes, et même dans les oméothermes, en regard du progressif perfectionnement que ce systeme acquiert dans la période de développement des mêmes, car pendant que se développent les pouvoirs qui causent la thermogénésie animale se perfectionne la thermo-régulation, et la température des animaux adultes s'égale au degré qui appartient à la classe et à l'ordre.

La régulation thermique est donc liée au développement et au perfectionnement du système nerveux.

Mais cette fonction le système nerveux l'explique en *toto*, ou par centres et par voies nerveuses spéciales, ou mieux par des mécanismes spéciaux?

Existe-t-il une régulation thermique indépendante du système vaso-moteur?

EXISTE-T-IL DES CENTRES THERMIQUES?

Voilà les questions que je me suis proposé de résoudre après des recherches expérimentales.

Sur la première. Dans les névroses de l'isthme en bas l'existence de centres thermiques est beaucoup douteuse, car j'opine que les phénomènes d'élévation ou d'abaissement de la température jusqu'à présent remarqués sont liés à des désordres vaso-moteurs.

L'existence au rebours des mêmes centres dans les névroses de l'isthme en haut est un fait positif, assuré par des recherches expérimentales.

TECHNIQUE EXPÉRIMENTALE.

J'ai cherché à conduire mes recherches sur ce sujet dans les conditions les plus physiologiques que possible de l'animal: en localisant exactement la lésion par une technique spéciale;* en marquant de courbes thermiques après une longue période d'observations; et en usant des propres appareils thermo-électriques, dont l'un a été construit à dessein.

Vraiment je n'ai pas usé dans la technique expérimentale la trépanation et la chloroformisation en choisissant des lapins très jeunes, et en ayant auparavant bien étudié le rapport topographique entre les ganglions à la base du cerveau et la surface externe de la tête, j'ai pu léser les mêmes ganglions par diverses manières, dont la plus simple est avec une subtile aiguille de Pravaz, colorée à la pointe avec une solution de méthyl violet très saturée et séchée rapidement. Lorsqu'elle parcourt son trajet à travers les tissus, cette aiguille ainsi apprêtée les colore, et à l'autopsie de l'animal on peut ainsi voir le point d'arrêt de l'aiguille, et son trajet.

* Voyez: Nota preventiva "Centri Termici," Luglio. 1890. Tip. Salvati o seguente edizione della Riforma Medica, e l'altra pubblicazione col titolo "Se esistano Centri Termici e se esiste una regolazione termica indipendente dai vasomotori.

C'est ainsi que j'ai cru avoir bien localisé la lésion en la limitant à des points déterminés, sans causer de graves lésions collatérales, et en suivant, selon mon avis, la méthode la plus propre pour expérimenter dans les conditions de l'animal les plus physiologiques que possible.

Pour les mesures thermo-électriques j'ai usé les aiguilles d'Arsonwall et construit en outre un galvanomètre spécial, qui par le courant thermo-électrique qui se développe d'une de ses aiguilles mise en un medium à 38°, donnait un arc impulsif de 20°.

COROLLAIRES EXPÉRIMENTAUX.

Les résultats expérimentaux que j'ai obtenus sont: (1) En lésant le thalamo optique, on observe une élévation thermique générale avec prépondérance à la moitié correspondant à la lésion et à l'artum supérieur. (2) En lésant le tuberculum quadrigeminum antérieur, on observe une élévation thermique générale avec prépondérance à la moitié correspondant à la lésion et dans l'artum inférieur. (3) L'injection dans les ventricules latérales cause un abaissement de la température. (4) J'ai produit des lésions corticales, soit après piqûre (toujours à l'obscure), soit en faisant une fenêtre au crâne et en injectant dans les lacunes ipoméningées de l'eau distillée colorée avec le méthyl violet, pour connaître l'extension de l'irritation corticale.

Les courbes thermiques sont signées par les apparats thermo-électriques, et ont démontré constamment un abaissement de la température qui dure pendant plusieurs jours.

CENTRES THERMO-INHIBITOIRES CORTICAUX ET CENTRES THERMOGÈNES BASILAIRES.

Les centres thermiques sont donc distingués en thermo-inhibitoires, qui sont les corticaux, et dans le lapin se trouvent dans le lobe fronto-parietal; et en thermomoteurs ou dynamo-thermiques ou encore thermogènes, et se trouvent dans les ganglions basilaires.

Je ne peux entrer dans l'étude critique des centres thermiques, et par suite, malgré mon désir, je ne peux énoncer les autres faits qui rendent positif leur existence.

Je suis convaincu que le secret pour déceler les fonctions du cerveau (du grand coordinateur de tous les centres réflex ordonnés) consiste à expérimenter dans les conditions les plus physiologiques que possible.

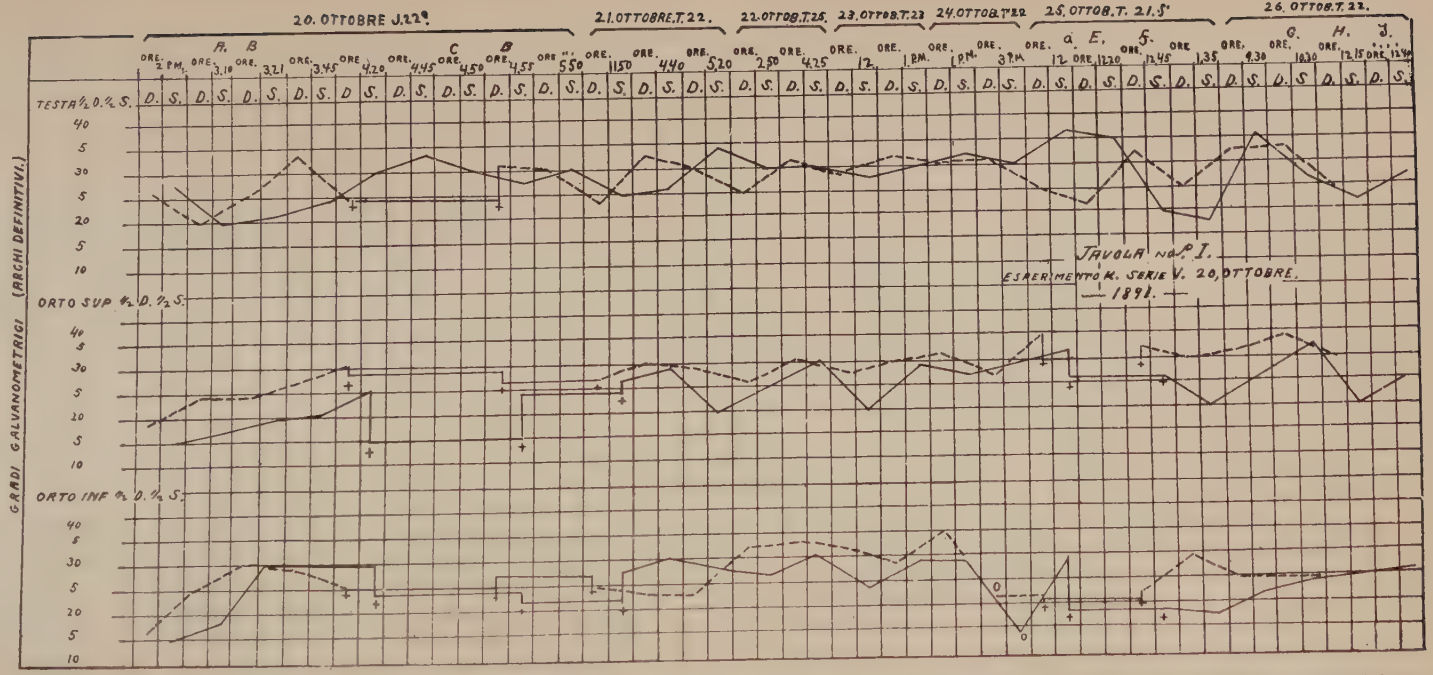
OÙ EXISTE LE MÉCANISME RÉGULATEUR DE LA CHALEUR?

La mécanisme régulateur dans la production de la chaleur ne réside pas dans la moëlle épinière. Ici existent vraiment dans les colonnes latérales les fibres thermiques qui partent des centres thermiques encéphaliques, pendant que la fonction thermo-inhibitoire appartient sans doute à l'écorce cérébrale, qui a de même la fonction d'inhibition des autres mécanismes réfléchis et ordonnés.

RÔLE DES VASO-MOTEURS DANS LA RÉGULATION DE LA CHALEUR.

Pour répondre à l'autre question: "Existe-t-il une régulation thermique indépendante du système vaso-moteur?" il faudrait l'éprouver expérimentalement: (1) Quelle importance a le système vaso-moteur dans la thermogénésie et dans la régulation thermique? (2) Si l'activité des centres thermiques agit directement ou par les centres vaso-moteurs?

Pour résoudre la première question, j'ai fait plusieurs recherches, qui m'ont donné les résultats suivants: (*a*) L'élévation thermique qui suit la neuro-parésis ou la nevro-paralisis vaso-motrice ne surpasse nullement la température moyenne du sang. (*b*) En excitant, ou en coupant le filet cervical du sympathique, dans le lapin, après avoir lié l'artère carotide, on n'observe pas de faits d'ipothermie, ou d'iperthermie locale. (*c*) Nulle quote-part d'élévation thermique n'est causée par la coupe du sympathique qui ne soit en rapport direct: avec une plus active circulation, avec le



N. B.—A. Dopo preparazione della carotida sinistra. B. 6 minuti dopo puntura del talamo ottico sinistro. C. Allacciatura della carotida sinistra. D. 5 minuti dopo allacciatura carotida sinistra. (a) Inizio del dissanguamento.
E. Dopo tolti 2 grammi di sangue da ambe le orecchie. F. Dopo tolti 13 grammi di sangue dalla giugulare destra. H. Dopo tolti 11 grammi di sangue dalla carotida destra.
I. Dopo tolti 13 grammi di sangue dalla carotida sinistra (in sotto al punto d' allacciatura).
D. Metà destra .... Temperatura della ferita al collo per la preparazione della carotida sinistra 28°. T. Temperatura dell' ambiente. O. La temperatura in questi 2 punti è pressa dopo lavaggio dell' orto.
S. Metà sinistra ——— Temperatura della ferita al collo per la preparazione della carotida sinistra 22°. + ——+ Nei tratti così segnati manca l' osservazione della curva termica.
.... Morte dell' animale. Manca l' ultima temperatura di tutta la metà destra.

degré de la chaleur accumulée dans le sang, et avec la différence de la température entre le sang même et le corps ambiant externe. (*d*) Les phénomènes de neuro-paralisis vasculaire ne modifient pas la courbe des variations ascensionnelles ou de descente de la température locale (oreille du lapin) qui suit, au contraire, l'allure thermique génerale causée par l'offense des centres thermiques encéphaliques.

LES VASO-MOTEURS SONT LES DISTRIBUTEURS HYDRAULIQUES DE LA CHALEUR.

Le système vaso-moteur règle donc la distribution de la chaleur dans l'organisme, puisqu'il règle l'activité du cœur et le ton des vaisseaux. *

Aussitôt qu'il règle l'hydraulique de l'organisme, il régle pareillement la dispersion de la chaleur.

RÈGLE EN MÊME TEMPS LA DISPERSION DE LA CHALEUR.

J'appelle cette régulation du nom de périphérique pour bien la distinguer de l'autre régulation que je nomme centrale. La première est sous le gouvernement direct du système nerveux de la vie végétative, tandis que l'autre est sous le gouvernement du système nerveux de la vie animale.

Le système vaso-moteur est néanmoins un facteur principal de la nutrition des centres thermiques, car il règle la circulation du plasme nutritif dans ces centres en réglant le ton des vaisseaux.

ACTIVITÉ DIRECTE DES CENTRES THERMIQUES.

J'ouvre la deuxième question: Les centres thermiques mettent-ils en exécution leur activité directement ou par les centres vaso-moteurs? J'ai fait pareillement des recherches expérimentales pour résoudre cette question.

Pour ôter tout doute, il fallait séparer l'élément vaisseau de l'élément nerf (je demande pardon de cette maniere de m'exprimer) pour démontrer l'activité directe des centres thermiques.

EXPÉRIENCES.

J'ai pratiqué mes expériences de la manière suivante: Après avoir noté la température du lapin avec les appareils thermo-électriques, je le lie dans la douche de Schwann et bientôt l'animal entre dans un calme parfait; je note encore la température dans les mêmes points qu'auparavant; de suite je prépare la carotide et je note de nouveau la température de l'animal; je lie ensuite le thalamo optique par la méthode que j'ai exposée dans les précédentes publications, et j'observe, pendant un certain temps, la courbe de la température de l'animal dans les divers points notés précédemment, et après qu'elle s'est élevée, je lie l'artère préparée et j'observe ensuite l'allure des courbes thermiques dans les mêmes points qui ont été établis dès le commencement de la recherche.

Les planches I, II, III appartiennent à d'autres expériences que je n'ai pas publiées dans les précédents écrits, et tendent à rendre plus évidentes les inductions que j'ai faites sur cette deuxième question.

Expérience C, (Série V.)

Lapin rougeâtre, du poids de 11 grammes. Je fais la piqûre du thalamo optique avec une aiguille de Pravaz teinte jusqu'à moitié de sa longueur avec une solution alcoolique très saturée de méthyl violet. L'aiguille est enfoncée de 3 mm. de la suture interpariétale, et à 2 mm. de la branche gauche de la suture lambdoïde, en entonçant l'aiguille de 2.05 cm. environ, jusqu'à faire paraître des petites secousses convulsives. Je laisse l'aiguille ainsi pendant 5 minutes seulement, en donnant à la pointe des petits mouvements latéraux.

* L'existence des ganglions idio-vasculaires d'Huizinga est bien connue. Les recherches de Ludwig et Mosso sur les vaisseaux des chiens récemment extirpés et parcourus d'un courant de sang; la restriction du calibre des artères jusqu'à l'occlusion complète de la lumière après des stimulus directs (Ludwig); la poursuite de la pulsation des veines dans la membrane volitante des chauve souris après la recision de tous les nerfs (Luchsinger); tous ces faits affirment l'innervation locale des vaisseaux par ces ganglions idio-vasculaires.

Arrêté les premières secousses, qui durent environ 6 minutes; aucune autre ne paraitrait pendant toute l'observation, et pareillement nulle vascularisation ne paraîtra dans les deux pavillons des oreilles du lapin. L'observation sur ce sujet dura 8 jours, après lesquels il fut tué en lui ôtant le sang. Voir la planche I pour l'allure de la courbe thermique et pour les autres remarques de la recherche.

Autopsie.—Lésion du thalamo optique gauche jusqu'au ⅓ de son épaisseur. Dans les autres organes on n'observe rien d'anormal.

Résultat expérimental.—La courbe thermique nous montre qu'après avoir lié la carotide gauche et pendant les jours successifs la température de la moitié gauche (côté correspondant à la lésion du thalamo) est restée en général plus élevée du côté droit, quoiqu'elle ait suivi la courbe thermique, ou l'allure propre aux lésions du thalamo optique.

Dans l'expérience suivante l'animal a été en observation pendant 34 jours, et la carotide a été liée 7 jours après la lésion du thalamo optique.

Expérience L, (Série V.)

Lapin gris du poids de 1,150 grammes. Je fais la piqûre du thalamo gauche comme il a été décrit ci-dessus.

Le lapin n'est pas pris de secousses convulsives, mais seulement d'hyperesthésie dans l'artum inférieur gauche, parce que l'animal crie avec force lorsque j'enfonce l'aiguille.

La perte de poids de l'animal est remarquable.* Pour la courbe thermique et pour les autres remarques de l'expérience voir planche II. Le lapin fut tué, en lui ôtant le sang.

Autopsie.—Lésion très évidente du thalamo optique où la course de l'aiguille était tracée au milieu des tissus de la peau en bas. Dans les autres organes nul fait anormal n'est observé.†

La persistance de la coloration du méthyl violet après un temps aussi long est due à la technique expérimentale que j'ai suivie.

Le résultat de l'expérience confirme tout ce que j'ai observé dans l'autre recherche susdite.

L'expérience suivante n'a pas été suivie de l'autopsie car le lapin vit encore.‡

Expérience M, (Série V.)

Lapin noir du poids de 1,700 grammes. Je fais la piqûre du thalamo optique gauche comme il a été décrit ci-dessus. Après la piqûre, un mouvement de manège à droite est évident, lequel persiste pendant 11 jours et peu à peu diminue d'intensité, et le vingtième jour le lapin est en état de calme parfait, mais si on effaroucho l'animal en le mettant en fuite, le mouvement de manège se reproduit de nouveau.

Nous rencontrons dans cette recherche un seul fait nouveau: c'est le mouvement de manège. Mais ce symptôme est dû à la lésion des fibres du pédoncule par la poussée de l'aiguille dans sa course.

En examinant la courbe thermique, planche III, on voit qu'à gauche, où a été liée la carotide, la température s'est élevée jusqu'à 12° au-dessus de l'état normal, et a suivi les modalités des courbes thermiques dans les lésions du thalamo optique.

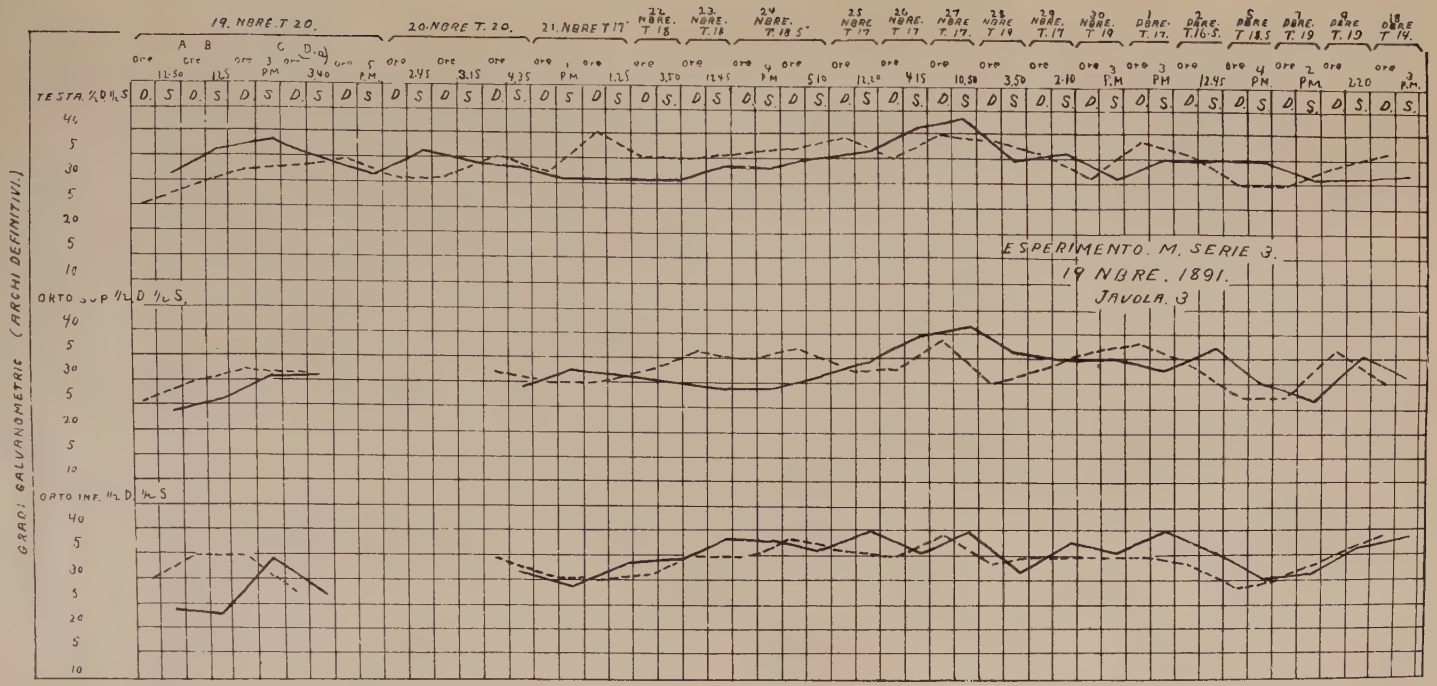
RÉGULATION DES OBJECTIONS PAR DES AUTRES RECHERCHES EXPÉRIMENTALES.

Dans ces recherches je crois presque du tout éliminée l'activité vasculaire, puisqu'en ayant essayé ce sujet avec des autres expériences de preuve pour répondre à des objections scientifiques ou expérimentales, qui peuvent être mises en évidence en regard j'ai observé: (*a*) Que les effets de la blessure au col pour lier la carotide

* J'ai remarqué ce fait même dans les autres expériences déjà publiées. Voir page 47 de la Monographie "Centri termici e Centri vaso-motori in ordine alla termodinamica regolarizzatrice in condizioni normali e patologiche. Napoli: Tip. Salvati. Marzo, 1871.

†Dans cette expérience, comme dans les autres déjà publiées, j'ai remarqué seulement tout ce qui touchait à la région encéphalique parce que je n'ai rencontré aucune lésion dans les autres organes. Pour cette raison les autopsies sont complètes.

‡Le défaut d'autopsie ne diminue pas l'importance de cette recherche, parce qu'en suivant la technique expérimentale ci-dessus décrite, dans de longues séries de recherches, j'ai pu acquérir une sûreté technique dans les lésions des ganglions à la base du cerveau. Comme j'ai pu le démontrer à une commission de cette faculté de médecine, composée des professeurs de Martini, Antonelli, Armanni, qui furent présents à une des expériences dans laquelle l'autopsie du lapin fut pratiquée par le Prof. Armanni, et où la lésion du thalamo optique que j'avais produite en leur présence fut rencontrée parfaite.

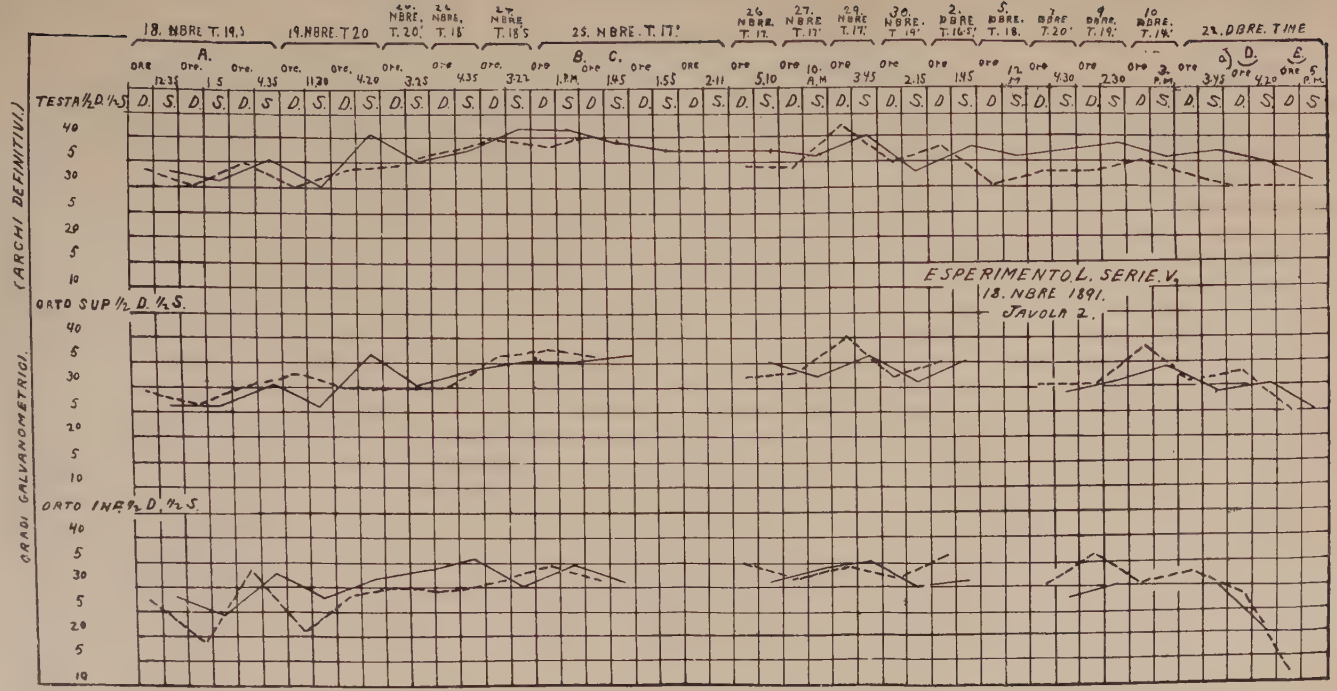


N. B. A. Ore 1.18 p.m. Puntura del talamo ottico sinistro. B. Dopo 7 minuti dalla puntura del talamo. C. Ore 3.30 p. m. allacciò la carotida sinistra. D. 10 minuti dopo l' allacciatura della carotida sinistra. ⌣. Dopo l' allacciatura l' orecchio sinistro è piu vascolarissato del destro.

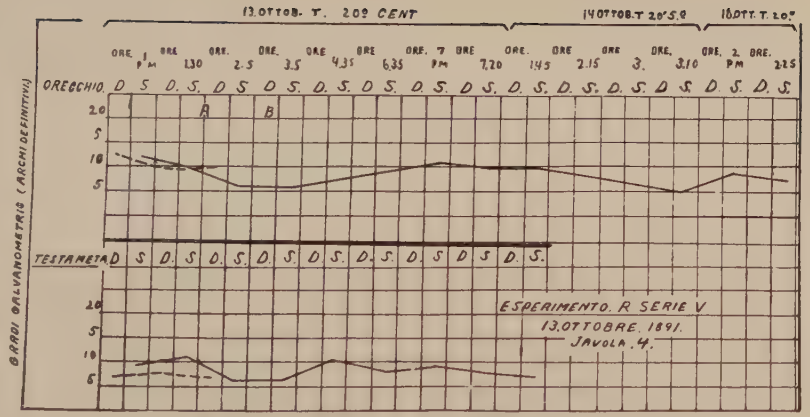
D. . . . Metà destra. T. Temperatura dell' ambiente in cui si sperimentava. + Temperatura della metà destra in tal giorno.

S. ———— Metà sinistra. °. Temperatura della metà sinistra in tal giorno.

In detto sperimento l' operazione della curva termica è durata 29 giorni. L' animale vive tuttora.

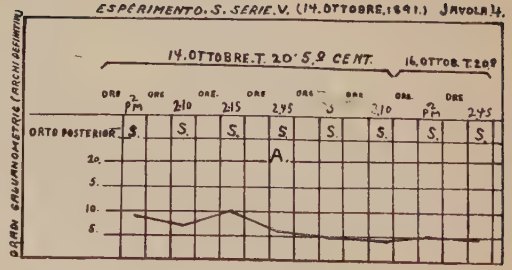


N. B.— A. Dopo 5 minuti dalla puntura del talamo ottico sinistro. B. Sette ore 1.35 di tal giorno allacciò la carotida sinistra. C. 6 minuti dopo l' allacciatura della carotida sinistra. *a*). Inizio del dissanguamento.
D. Dopo tolti 5 grammi di sangue dalla carotida destra. E. Dopo tolti 31 grammi di sangue dalla carotida destra.
D. ..... Metà destra. T. Temperatura dell' ambiente in cui si sperimentava.
S. ———— Metà sinistra.
In detto sperimento l' allacciatura della carotida si pratico dopo 7 giorni dalla puntura del talamo ottico. L' osservazione è durata 34 giorni. L' animale perdette di peso (dopo 11 giorni dalla puntura gia 80; dopo 14 giorni 180 ore).



N. B.—A. Ad ore 1.35 s' allaccia la carotida sinistra. B. Da questa misura in più furon sospese quelle della metà destra, osservandosi solo le sinistre per ragioni facili ad intendere.

D. . . . . Metà destra.
S. ——— metà sinistra.
T. Temperatura dell' ambiente in cui si sperimentava.



N. B.—A. 20 minuti dopo l' allacciatura della crurale sinistra.

S. — ——— metà sinistra.
T. Temperatura dell' ambiente in cui si sperimentava.

n'altèrent pas les résultats expérimentaux de la recherche parceque la ligature de la carotide a été pratiquée immediatement après la piqûre du thalamo optique, en certaines expériences, autrefois après plusieurs jours, et les résultats de la recherche (en regard des courbes thermiques) sont restés identiques. (*b*) En ayant lié la carotide et la sous-clavière, et en ayant ensuite coupé encore le filet cervical du sympathique dans le lapin. Je n'ai pas observé l'élévation thermique dans l'oreille du lapin. Ces expériences vont même à l'encontre de l'objection: que les anastomosis terminales des artères puissent réintégrer la circulation dans le champ des occlusions des artères, et même la température. Les faits expérimentaux démontrent sans doute le contraire de l'objection susdite, parceque la température dans le champ d'occlusion de la carotide est plus élevée que dans le côté, où la circulation est normale. Cette élévation même est évidente; soit après l'occlusion de l'artère, soit dans le parcours de plusieurs jours successifs (trente et plus encore). (*c*) Est-il même éliminé? Sans doute que l'anémie du centre lésé, en opérant comme une excitation, eût pu causer l'iperthermie parcequ'une ample vascularisation est établie pour le cercle artérien de Willis, et les phénomènes d'iperthermie sont continués pour plusieurs jours, après l'occlusion de la carotide. (*d*) Est-il éliminé encore? Sans doute que l'élévation de la température, après l'occlusion de la carotide, est causée par l'anémie des tissus (pour la ligature des grosses tiges artériennes) dans le côté de la tête répondant à la lésion, parceque, quoiqu'il soit bien connu que dans les parties de l'organisme où la circulation du sang est supprimée, la température s'abaisse rapidement, les expériences que j'ai faites ont démontré assurément un abaissement de la température dans les côtés où était close la circulation des grosses artères (carotide, etc.).

Voici les remarques expérimentales:

Expérience R, (Série V.)

Je note la température des oreilles et des deux côtés de la tête d'un lapin. Je clos ensuite la carotide gauche, et je note pour trois jours l'allure de la courbe thermique des mêmes places.

La température (voir planche IV) reste toujours plus basse qu'avant l'occlusion de l'artère.

Expérience S, Série V.

En un lapin je note la température de l'artum postérieur gauche, et ensuite je clos la crurale.

La température s'abaisse, comme il est remarqué dans la planche IV, où on voit l'allure des courbes thermiques des deux recherches susdites, qui démontrent précisément la faiblesse du doute sus-énoncé: Que l'élévation thermique qui suit aux légions des centres thermiques ne puisse pas se rapporter à la fièvre de réaction du traumatisme cérébral, parceque le trauma avec la méthode que j'ai suivie est ramené aux limites les moindres que possibles.

C'est une piqûre avec une mince aiguille de Pravaz, parce que j'ai banni de la technique la trépanation, la chloroformisation, etc. A la fin on ne peut pas mettre au nombre des fièvres de réaction les élévations thermiques remarquées au-delà de 30 jours.

Ces élévations thermiques sont plus remarquables parce que l'aiguille est enfoncée dans le tissu cellulaire sous-cutané, qu'à une température moins élevée que les autres tissus.

ENCORE SUR L'ACTIVITÉ DIRECTE DES CENTRES THERMIQUES.

L'activité dynamogène directe des centres thermiques est manifestée aussi par un autre fait:

Souvent il arrive dans les observations thermo-électriques que le galvanomètre ne marque pas le même arc, quoique avec la même vitesse on enfonce l'aiguille dans les tissus, on l'approfondisse pour la même longueur et on l'enfonce encore dans la même fenêtre cutanée pour observer la température de la même place.

Ce fait est-il causé par les oscillations de l'activité dynamogene directe des centres thermiques ou par les actions vasculaires?

Pour résoudre ce doute j'ai expérimenté ainsi: J'ai enfoncé l'aiguille thermo-electrique, trempée dans la paraffine et gardée à une température constante avec l'étuve de Meyer, et j'ai toujours noté un arc galvanométrique constant.

Bien, pourquoi dans les observations de la température de l'animal dans les conditions susdites, avons-nous des arcs galvanométriques qui varient de l'un à l'autre moment?

Voici les recherches que j'ai faites: Ayant, sur le thorax d'un lapin, appliqué le cardiographe, je recueillis sur un cylindre mu par le régulateur de Foucault le cardiogramme (le cylindre achevait un tour pendant 3 minutes).

Sur le cardiogramme je remarquai que l'intervalle entre les deux ordonnées systoliques était en moyenne presque 3 mm.

C'est pour ça qu'ensuite je disposai le signal électrique de Depretz en le réglant avec un métronome de telle manière qu'il traçat sur le même cylindre une courbe (parallèle au cardiogramme) avec une série d'interruptions qui se suivaient à 3 mm. d'intervalle, c'est-à-dire la distance qui était entre les deux ordonnées systoliques du cardiogramme.

Ayant ainsi disposé les choses, j'enfonçai sous la peau l'aiguille thermo-électrique dans le même moment complétant le circuit électrique entre le métronome et le signal électrique.

Il est bien évident qu'ainsi les interruptions du signal électrique étaient marquées sur le cylindre, que de systoles du cœur du lapin, toutes les fois que l'activité cardiaque ne variait pas pendant l'expérience.

Bientôt je pus remarquer que le cardiogramme, en plusieurs rencontres, coïncidait (pour la série des ordonnées systoliques) avec les interruptions du signal électrique, et en de tels rencontres l'aiguille thermo-électrique notait de très rapides oscillations de la température, rendues très évidentes par des arcs galvanométriques très variables sur le champ.

Quoique dans cette expérience les activités vaso-motrices ne soient pas tout à fait éliminées, néanmoins en la comparant avec les autres énoncées ci-devant, je crois qu'on peut en inférer que de telles variations si sensibles de l'aiguille thermo-electrique sont causées par l'activité dynamogène directe des centres thermogènes basilaires.

La très sensible variabilité des températures locales est un fait que j'ai remarqué autrefois.

La variabilité des arcs galvanométriques est évidente en passant de l'une à l'autre observation thermo-électrique, quoiqu'elles fussent environnées de toutes les finesses qui sont ordonnées par l'électro-technique.

Cette variabilité varie en certaines limites, qui suivent en général la courbe thermique ascensionnelle ou de descente que l'animal montre pendant l'expérience.

Par les expériences susdites et par les autres que j'ai publiées auparavant, je crois avoir des bases solides et je suis à la fois autorisé à confirmer tout ce que j'ai publié dans les années précédentes sur la fonction thermique spéciale des centres nerveux.

COROLLAIRES SUR LA RÉGULATION DE LA CHALEUR.

Ayant démontré l'inhibition thermique corticale sur les centres basilaires, de même que le manteau cortical a l'inhibition sur tous les centres automatiques et ordonnés, qui sont au-dessous dans la névraxe, il est bien claire: (1) Que la régulation de la chaleur est due à l'équilibre entre des forces opposées qui s'expliquent entre les centres thermo-basilaires (thermogènes) et les centres cortico-inhibitoires-thermiques. (2) Que selon la prépondérance de l'activité fonctionnelle des premiers sur les autres il y a hyperthermie ou hypothermie. (3) Que la somme des tensions dynamiques, thermiques et partielles, causées par l'excitation de chacun des centres thermiques, doit être égale à la tension de tous les centres à fonction homologue.

Voici l'effet utile qui résulte de l'énergie de tels centres, symbolisé avec la formule:

$$CT_a+CT_b+CT_c=CT\ (a+b+c),$$

ou CT est le symbole d'un centre thermique, et *a*, *b*, *c* sont les symboles de chacun des centres susdits (corps striatum, thalame, etc.).

Voici la régulation que je nomme centrale, dans le domaine du système nerveux de la vie animale.

MÉCANISME DE LA RÉGULATION DE LA CHALEUR.

Physiologiquement la fonction régulatrice de la chaleur est une, mais pour en entendre la mécanique j'ai divisé les deux principaux mécanismes (qui sont tout-à-fait sous le domaine du système nerveux) en les contre-signant avec le nom de régulation centrale et de régulation périphérique.

Ceci, bien plus, est un système de compensation physiologique très important qui arrive pour faire acquérir à la température animale (dans les homéothermes) une moyenne constante.

La régulation automatique des vaisseaux influe indirectement sur la fonction des centres thermiques, pour l'influence qu'a sur la nutrition des mêmes.

Voici un lien nutritif entre régulation centrale et régulation périphérique; c'est le lien harmonique entre le système nerveux de la vie anormale et l'autre de la vie végétative. Mais il y a encore un autre lien, le fonctionnel.

C'est précisément ce lien là qui exerce l'écorce cérébrale avec son activité cortico-inhibitrice aux centres thermiques, basilaires, (ou thermogènes) et cortico-inhibitrice aux centres vasomoteurs.

Puisque les voies réfléchies des arcs diastaltiques thermiques doivent être tout-à-fait distinguées par les autres aussi réfléchies des arcs diastaltiques vasomoteurs corticaux. Tandis que les premières vont aux centres basilaires thermogènes, les autres vont aux centres vasomoteurs du bulbe et de la moelle épinière.

PLANCHE EXPLICATIVE DE TEL MÉCANISME.

Tous les deux systèmes d'arcs diastaltiques, quoiqu'ils aient tel lien intime, jouissent d'un automatisme fonctionnel dans le domaine de l'activité cortico-inhibitrice de l'écorce cérébrale.

C'est pour de tels mécanismes que la faculté d'équilibre entre la production thermique et la dispersion a des limites physiologiques très amples dans les animaux et plus encore dans l'homme, qui a le système de coordination le plus parfait, dans tous les mécanismes réfléchis ordonnés.

La planche V rend bien clair la dynamique de tels mécanismes. Il faut à la fois dire que chaque centre thermique (thermogène ou cortico-inhibitoire), comme tous les centres nerveux, est centre d'un arc diastaltique avec des voies incidentes et des voies réfléchies. Les incidents sont les thermo-sensitives et elles vont avec les voies de sens,* les refléchies sont bien distinguées, selon qu'on traite des centres thermo-inhibitoires corticaux, ou des centres inhibitoires corticaux aux vasomoteurs, ou après tout des centres thermogènes basilaires.

Les voies réfléchies de ces derniers ont été demontrées expérimentalement, tandis que les voies réfléchies aux centres de l'écorce cérébrale sont admises avec assuré jugement et sont les mêmes voies par lesquelles se transmet la inhibition des centres corticaux aux centres automatiques ordonnés mis dessous, savoir: les thermogènes basilaires et les vasomoteurs.

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* Ces voies de sens encore, comme les voies motrices ont la decussation dans les pyramides, et forment ainsi le croisement pyramidal supérieur de Meynert. Voir page 56 de ma publication, 1ère édition, 1891: "Se esistano centri termici e se esista una regolazione termica indipendente dal sistema vasomotore."

Pour tels mécanismes la production thermique est réglée par le système d'arcs diastaltiques thermiques, qui ont leur centre dans les cortico-inhibitoires thermiques et dans les thermogènes basilaires, tandis que la dispersion est réglée par l'autre système d'arcs diastaltiques, qui ont pour centres les cortico-inhibitoires aux vasomoteurs, les centres vasomoteurs et la série ordonnée de ces derniers. (Voyez planche V).

Les mécanismes de tous les deux régulations sont activés en conditions physiologiques par stimulus réfléchis constants.

ENCORE SUR LE MÉCANISME SUSDIT.

L'harmonie de la production thermique avec la dispersion physiologiquement subite des oscillations, qui trouvent leur interprétation dans la variabilité des stimulus de l'ambient externe (dans le sens le plus large du mot).

La régulation de la chaleur en conditions physiologiques ne pourrait s'activer sans les voies incidents et sans les stimulus du monde externe (dans le sens plus large du mot) sur telles voies.

La température des homéothermes subira des graves oscillations, ne garderait pas la température media physiologique constante à chaque ordre et classe. C'est pour ça que la nature a multiplié les voies incidentes* sur les motrices (les réfléchies).

Il est bien clair, qu'il existe une apperception thermique liée aux activité cortico-thermo-sensorielles. Parce qu'étant le sensorium commun avisé de toutes les variations des stymulus périphériques (dans les sens plus large du mot) tout à la fois excités même les centres régulateurs du dynamique termique, qui sont activés physiologiquement par excitation réfléchie et constante, car l'excitation authocthone, n'est pas le stimulus ordinaire.

Dans un champ si vaste de centres d'arcs diastaltiques, thermiques et vasomoteurs les stimulus authocthones ne peuvent être portés que par le plasma qui les arrose.

THÉORIE SUR LA FIÈVRE.

C'est pour ça que l'abnorme crasis du plasma, le chimisme altéré du plasma qui les arrose, vient traduit en faits de dynamique thermique altérés par imparfaite fonctionalité de la série ordonnée des mécanismes thermiques et dispersifs.

Altérée de cette façon la nutrition de tels centres nerveux, l'organisme est en proie du procès fébrile.

La voici la cause unique productive du procès fébrile: C'est la crasis du plasma altérée pour changement chimico-moléculaire du même, qui influe directement sur la nourriture des centres des arcs diastaltiques thermiques et des arcs diastaltiques vasomoteurs.

En conséquence il y a la rupture des harmoniques rapportés (lien nutritif et fonctionnel sus-énoncé), par lesquels vient accomplir la fonction thermo-regulatrice physiologique.

Par l'altérée nourriture des centres des arcs diastaltiques susdits en suit une faiblesse dynamogene nerveuse, qui se traduit sensiblement en une moindre célérité de vibrations de l'éther nerveux.

La diminution de la quantité de mouvement de l'éther nerveux en telle rencontre est telle que ne peut pas modifier l'extension, la célérité, la direction des vibrations de l'éther, traduit sensiblement en chaleur par les activités chimiques des tissus.

Elle est parétique sans doute dans le système nerveux l'activité qui rend harmonieuse les vibrations de l'éther nerveux à l'état de vue des éléments cellulaires. Est-elle paréthique précisément l'activité apte à traduire la chaleur chimique en chaleur organique vitale, c'est-à-dire: "Telle qui ne puisse altérer la vie des protoplasmes cellulaires."

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* Les Physiologistes opinent que les fibres de sens soient presque deux fois autant que les fibres motrices. Voyez Paladiuo, 1885. Instit. Physiol. et des autres Traité de Physiologie.

L'organisme ainsi est en proie des activités chimiques, qui s'exagèrent même pour les changements chimiques moléculaires du plasma, qui influent à son tour sur la nourriture des autres protoplasmes cellulaires, en rendant anormale la nutrition, et en accélérant en plusieurs rencontres la totale désagrégation moléculaire.

La doctrine physio-pathologique de la fièvre, comme j'ai déjà publié depuis longtemps dans mes précédents ouvrages, doit être fondée sur l'altérée nourriture des centres de la série ordonnée des arcs diastaltiques thermiques et vasomoteurs pour l'altérée crasis du plasma, et en conséquence, sur l'altérée mécanique régulatrice thermique, rendue anormale dans les fonctionnements des deux mécanismes susdits: le central pour la production de la chaleur, et le périphérique pour la dispersion.

CENTRES THROPHIQUES.

Sur la question: Si les centres thermiques soient même centres throphiques, je crois pouvoir donner aussi des modestes résultats.

Les recherches expérimentales m'ont démontré que les animaux lésés en tels centres perdent du poids.

Ce fait, je l'avais déjà remarqué à page 53 de ma dernière publication.*

Le lapin de l'expérience S (Série V), 4 Mars 1891, perdit en 10 jours 60 grammes de son poids, et la température fut toujours au-dessus de la normale.

Le lapin de l'expérience L (série V), 18 novembre 1891, perdit de poids après 11 jours de la lésion encéphalique 80 grammes, après 14 jours 180 grammes.

Donc une preuve presque directe pour inférer que les centres thermiques soient mêmes des centres throphiques.

Tout ceci est bien en harmonie avec les vues que nous avons déjà sur la nourriture de l'organisme. Il est bien connu que le mouvement thermique organique est lié intimement avec les acts nutritifs de l'organisme.

THÉORIE SUR L'INFLUENCE DU SYSTÈME NERVEUX SUR LA CHALEUR ORGANIQUE.

En ayant démontré que dans la régulation thermique le système nerveux n'agit pas en *toto*, mais par mécanismes réfléchis ordonnés, par centres thermiques et vasomoteurs, par centres et par voies spéciales, je dois conclure, quant à l'influence du système nerveux sur la production thermique, en opinant: que l'activité dynamogène nerveuse avec son mouvement vibratoire, modifie la célérité, l'extension, et la direction des vibrations de l'éther, mis en vibration par les actes chimico-biologiques, qui arrivent dans l'intime texture des tissus, avec phénomènes d'interférence de mouvement vibratoire, et avec modification dans la direction de la propagation de tel mouvement.

Le voici précisément dans la vie nutritive physiologique comment la chaleur chimique se traduit en chaleur organique vitale, c'est-à-dire en parfaite harmonie quant à son degré avec les conditions de vie des protoplasmes cellulaires.

Dans la vie nutritive pathologique, dans la fièvre, c'est-à-dire dans l'inanition pathologique désignée par des changements chimiques-moléculaires du plasma, la chaleur organique vitale, dans le sens susdit, se traduit en chaleur chimique, pour l'activité dynamogène affaiblie du système nerveux, ou mieux, pour la célérité vibratoire affaiblie de l'éther nerveux, qui pour cela n'a pas tout à fait la quantité de mouvement, telle qu'elle puisse modifier la célérité, l'extension et la direction des vibrations de l'éther, mis en vibration calorigène par les échanges chimico biologiques des tissus.

Comme j'ai déjà précédemment publié, il serait bien banal de songer que les centres thermiques (les thermogènes basilaires) soient producteurs de la chaleur.

Celle-ci est produite dans l'organisme par actions chimiques qui se produisent dans l'intime texture des tissus.

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*Voir Monographie "Centri termici e centri vasomotori in ordine alla termodinamica, ecc., 1891. Tip. Salvati: 2ª. ediz.

Cette chaleur, ce mouvement vibratoire de l'éther, est modifié par l'activité dynamogene du système nerveux, par les vibrations de l'éther nerveux.

Les centres thermiques étant centres d'arc diastaltiques sont des voies de conduction des vibrations de l'éther nerveux.

Telles vibrations sont excitées par les stimulus du monde externe (dans le sens plus large du mot), qui agissent sur les extrémités des voies incidentes de la sériation ordonnée des arcs diastaltiques.

Les mêmes vibrations de l'éther nerveux se propagent ensuite du centre de l'arc diastaltique par la voie réflechie, lorsque tels stimulus sont physiologiques, mais si au contraire ces stimulus sont abnormes, il se renverse la direction des vibrations de l'éther nerveux, il y a alors un transfert d'activité dynamogene, de la branche réfléchie dans les voies incidentes des arcs diastaltiques, et ainsi sont altérés les mécanismes ordonnés, par lesquels la vie s'explique.

RÉFUTATIONS DE QUELQUES EXPÉRIENCES DE HALE WHITE.

Je ne puis pas clore cet argument sans discourir d'une récente recherche d'Hale White publiée dans le Journal of Physiology, Vol. XII, Nov. 3 de 1891.

L'assemblée opine que la température des inguinées dans le lapin soit plus élevée que celle du rectum.

De ces résultats expérimentaux il infère des conclusions sur les ablations de l'écorce cérébrale, quant à l'influence de la même sur le rapport entre la température vitale et l'inguinale.

White expérimente ainsi: avec le même thermomètre mis dans le rectum, il passe à mesurer la température de l'inguinée. Il a remarqué dans cette rencontre que la colonne de mercure monte encore de quelque dixième pour 3 ou 4 minutes.

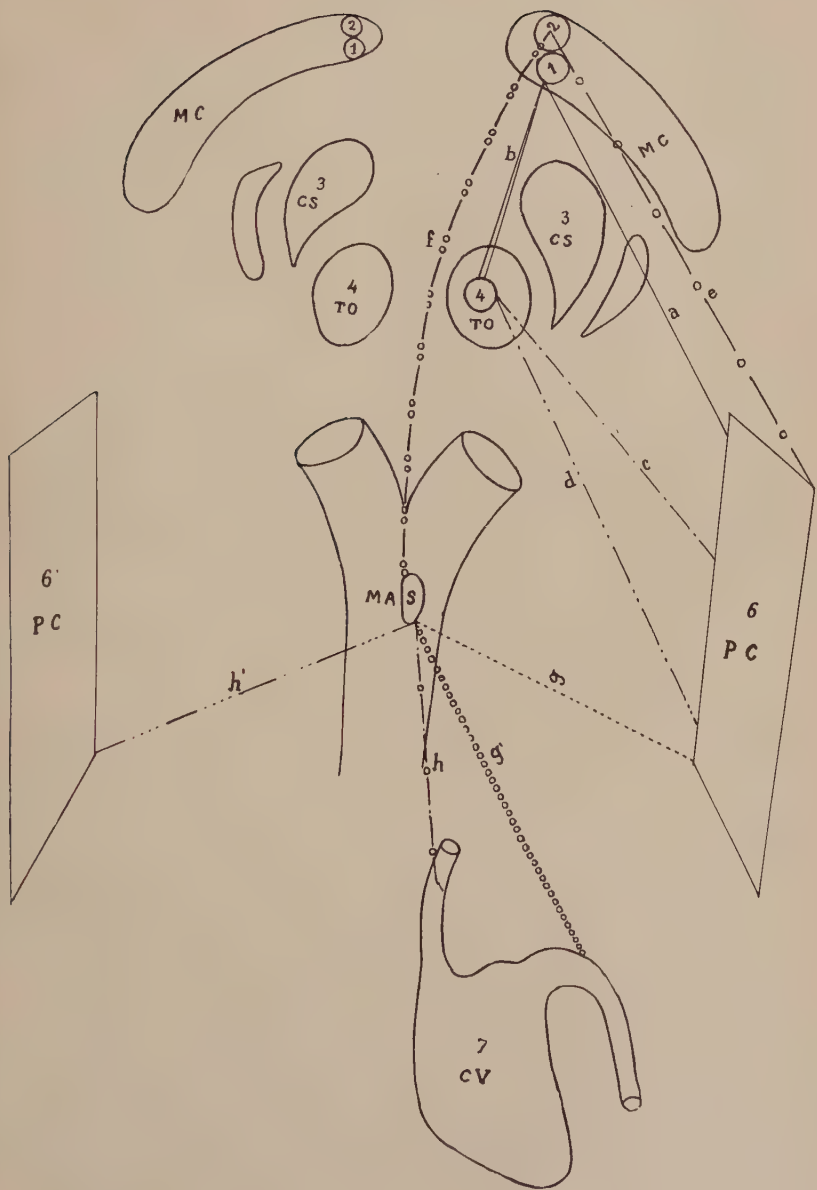
J'ai expérimenté même de cette façon, et d'avantage j'ai fait des autres recherches en observant la température avec des aiguilles et des sondes thermo-electriques, et j'ai eu des résultats opposés: la température anale a été toujours superieure à l'inguinale.

C'est pour ça que je n'ai pu pas suivre White dans ses vues sur l'influence de l'écorce cérébrale.

EXPLICATION DE LA PLANCHE V.

M. C. Manteau cortical.
C. S. Corps striatum.
T. O. Thalamo optique.
M. A. Moelle allongée.
P. C. Périphérie du corps (au sens large du mot.)
C. V. Appareil cardio-vasculaire.
1. Centres thermo-inhibitoires corticales.
2. Centres inhibitoires-vasomoteurs corticals.
3. Centres thermogène basilaires du corps striatum.
4. Centres thermogènes basilaires du thalamo optique.
5. Centres vasomoteurs de la moelle allongée (coordinateurs des autres centres ordonnés vasomoteurs périphériques et de la moelle épinière).
6, 6′. Extrémités terminales des voies nerveuses à la périphérie du corps et dans les systèmes cardio-vasculaires.
a. Voies thermo-sensitives (incidents au centre 1).
b. Voies thermo-motrices (réfléchies des centres (1) c'est-à-dire: voies inhibitrices de l'écorce cérébrale aux centres thermogènes basilaires).
c. Voies thermo-sensitives (incidentes au centre 4.) Elles parcourent le cingulum thalamicum.
d. Voies thermogénes ou thermo-motrices (sont démontrées expérimentalement et abornent dans l'intime texture des tissus, c'est pour cela que modifient les actions bio-chimiques).
e. Voies sensitives (incidentes au centre 2).
f. Voies motrices, inhibitrices aux vasomoteurs de la moelle (réfléchies des centres 2).
g g′. Voies incidentes de la périphérie ou du système vasculaire au centre (5) et sa dependance (centres vasomoteurs de la moelle).
h h′. Voies motrices (réfléchies des centres (5) et ses dépendances à l'appareil cardio-vasculaire.

PLANCHE V.



a 1 *b*. Symbolise le système des arcs diastaltiques thermo-inhibitoires corticaux A.

c 4 *d*. Symbolise le système des arcs diastaltiques thermogènes basilaires B.

e 2 *f*. Symbolise le système des arcs diastaltiques corticaux inhibitoires au centres vasomoteurs de la moelle allongée C.

g 5 *h e g'* 5 *h'*. Symbolise le système des arcs diastaltiques vasomoteurs de la moelle et périphériques P.

La mécanique thermique régulatrice des conditions physiologiques s'accomplit par deux systèmes d'arcs diastaltiques sériés entre eux: Les systèmes A et B par lesquels est accomplie la régulation centrale; et les systèmes C et D par lesquels est accomplie la régulation périphérique.

La mécanique des deux régulations est activée par stimulation réfléchie constante.

Tous les deux ont entre eux des liens intimes: Le nutritif et le fonctionnel. Tous les deux jouissent d'automatisme fonctionnel, sous le domaine de l'activité inhibitrice corticale. (V. 1ª Monographie au titre "Centri Termici," juillet, 1890, Tip. Salvati, et les autres successives.)

THE ABSORPTION OF IRON IN THE ANIMAL BODY.

By A. B. MACALLUM, M. D.,

Professor of Physiology, University of Toronto.

The author's observation on the distribution of iron in the animal and vegetable cell have resulted in determining that the chromatin of every species of cell is an iron-holding compound and that this substance gives origin to the hæmoglobin in the animal body. It follows from this that the iron of inorganic preparations in the food, if it is assimilated at all, must go directly to the formation, not of hæmoglobin, but of chromatin—a conclusion which necessitates a revision of the commonly accepted views as to the physiological relations of iron, and which at the same time suggests two interdependent questions: (1) Is chromatin formed in the animal body, or is it formed in vegetable organisms only? (2) What is the true explanation of the beneficial effects of the administration of iron salts?

In an attempt to answer these questions, various compounds of iron have been administered to animals (guinea pig, rabbit) in order to determine by micro-chemical and histological methods their action in the intestine. The investigation has yielded results which may be summarized thus:

(1) The chloride, phosphate, and sulphate of iron and certain organic preparations of iron are absorbed by the epithelial cells of the villi and by the siderophilous cells surrounding the lacteal vessels.

(2) When given in large doses, certain preparations of iron have, upon the absorbing elements, especially the siderophilous cells, an effect similar to chemotaxis.

(3) The absorption of iron compounds occurs chiefly in the upper and middle portions of the small intestine.

The beneficial effects of the administration of iron in anæmia may, in large part, be explained on the view that iron salts increase the absorptive activity of the intestinal mucosa. Other investigations on the absorption of chromatin tend to support this view and to indicate that inorganic and albuminate compounds of iron are not assimilated in the animal body, or, in other words, iron-holding nucleo-albumins are products of vegetable metabolism only.

The bearings of these observations on the pathology of simple anæmia and chlorosis and on the subject of nutrition is discussed at length in the original paper.

ON THE PROTEOLYSIS OF CRYSTALLIZED PHYTO-GLOBULIN OR VITELLIN.*

By Dr. R. H. CHITTENDEN.

The study of digestion is interesting and important in its chemical as well as in its purely physiological aspects. In the performance of the natural functions of the body these two phases are everywhere closely related. The phenomena to which each gives rise are dependent upon those of the other to a very great extent, and the normal or abnormal manifestation of the one series of actions always has a decidedly modifying influence upon the conditions of the other series. It is in its chemical aspects, however, that the basis of a correct interpretation of the digestive processes lies, and since proteid foods are essential to the very existence of the body the study of the chemical changes which these undergo in digestion is of great significance to the physiologist.

Considerable was known in a general way, previous to Meissner's work, regarding the greater solubility and diffusibilty of the end products of proteolytic action; but this investigator and Brücke were the first to advance more definite views as to the nature and reactions of these products. Their opinions, however, differed somewhat; the discordance being often due doubtless to a difference in the artificial conditions of their experiments and in the interpretation of their results. The more recent discoveries pertaining to the proteoses and true peptone are especially responsible for the present theories of the chemical physiology of proteid digestion. At the present time the study of the cleavage products resulting from the action of the gastric and pancreatic proteolytic ferments has been extended so as to include practically all of the common forms of proteid matter. All of the results obtained lend favor to the theory that in digestive proteolysis the large proteid molecule undergoes a series of progressive changes, resulting in a cleavage into relatively smaller molecules, representing bodies more soluble and more diffusible; thus they better fulfill the physiological requirements of absorption and an example is afforded of how important a part chemical transformation plays in the functional activity of the system.

The advances in the methods of separating the individual albuminoses or proteoses have given an added impetus to the study of the products obtainable from different proteids, especially in view of the natural diversity of proteid food stuffs. The resulting proteoses and peptones, as might be anticipated from their varied origin, show some noticeable differences in their reactions, as well as in their composition, although certain marked characteristics are common to all of a given series. Blood-fibrin, myosin, paraglobulin, egg albumin, elastin, gelatin, casein, and gluten-casein have all been investigated, and their digestive products carefully examined. This, to be sure, has extended our knowledge of the individual proteoses and given us much valuable information, but in order to understand thoroughly the precise nature of the digestive processes we need to be very sure of the exact nature and chemical composition of the proteid undergoing digestion. In any exact study of the relationship between the various products resulting from ordinary proteolytic action and the mother proteid, the purity of the latter must first be assured. Obviously the colloidal or amorphous character of ordinary proteids is a great obstacle to chemical purity. In crystallized phyto-globulin, however, we have a form of proteid matter, the crystalline character of which offers a comparatively easy means of insuring reasonable purity. These crystalline proteids have, indeed, been known for a long time, and Neumeister,† as well as the writer,‡ has previously

* Abstract of a paper by R. H. Chittenden and L. B. Mendel.

†Ueber Vitellosen; Neumeister, Zeitschrift für Biologie, Band 23, p. 402.

‡Crystalline globulin and globuloses or vitelloses. Chittenden & Hartwell, Journal of Physiology, vol. ii, p. 435.

reported on a few experiments designed to throw some light on the character of their digestive products. Hitherto, however, the great difficulty attending the preparation of large quantities of these crystalline proteids, and the somewhat vague ideas as to their nature, have constituted obstacles sufficiently great to interfere with their use in digestion experiments.

Within the last two years Osborne,* making an extended study of the crystalline vegetable proteids, has called attention to the relative abundance of a beautifully crystallized globulin or vitellin in hemp seed. This proteid we have been able to isolate in a state of perfect purity in quantities sufficient for all practical purposes, and with this product have attempted a further study of the proteoses and peptones obtainable by the action of both pepsin and trypsin.

The hemp seed proteid crystallizes in the form of clean cut octahedra with some hexagonal plates. Under the microscope the crystals are seen to have as sharply defined edges as crystals of arsenious oxide freshly sublimed, thus showing the absence of amorphous impurities. It is a typical globulin, or phyto-vitellin, practically insoluble in water, but easily soluble in 10 per cent salt solution, especially when warm, and crystallizing readily from a hot saturated solution as the fluid cools. Further, when a salt solution of the proteid is dialyzed the vitellin frequently separates in crystalline form as the salt diffuses. In fact, it is a globulin exceedingly prone to crystallize, even under what might be termed unfavorable circumstances, a peculiarity which tends to give an assurance of purity. It is readily soluble in 0.2 per cent hydrochloric acid and in 0.5 per cent sodium carbonate, being readily converted, especially with the aid of heat, into acid albumin and alkali albumin, respectively. Like all globulins, it is more or less coagulable by heat, but is peculiar in that the coagulation point is exceedingly high; thus, a 10 per cent sodium chloride solution containing 0.5 per cent of the proteid does not show any signs of turbidity until a temperature of 79° C. is reached and flocks do not appear until the temperature rises to 91° C. Even then, and indeed on boiling the solution, coagulation is very incomplete. A quantitative experiment tried in this connection is interesting as showing how little confidence can be placed in separations made solely by heat precipitation. Thus, 10 grams of the pure crystallized proteid were dissolved in about a liter of 10 per cent salt solution and the fluid heated to boiling and kept at that temperature for thirty minutes. The flocculent coagulum resulting was filtered off, washed, and weighed. It amounted to just about 50 per cent of the original proteid. The filtrate from this heat-precipitate was then dialyzed until the greater portion of the salt was removed, when the remaining globulin separated out in the original crystalline form, thus showing that it had not been altered by the prolonged exposure to the high temperature. Again dissolved in salt solution and exposed to 100° C., another coagulum gradually formed; and doubtless if this process had been repeated a sufficient number of times the entire quantity of globulin would have been coagulated. Evidently, however, this vegetable globulin is very slowly coagulable by heat.

The composition of the crystallized proteid is much the same as that of the more frequently analyzed squash seed globulin, being especially characterized by a high content of nitrogen and a correspondingly lower content of carbon. Thus, the average composition of several distinct preparations shows 51.58 per cent of carbon, 6.88 per cent of hydrogen, 18.80 per cent of nitrogen, 1 per cent of sulphur, and 21.65 per cent of oxygen.

Like all proteid bodies, this phyto-vitellin is lævorotary; dissolved in 10 per cent salt solution it has a specific rotation of $\frac{a}{D} = -53.8°$. Haas has determined the specific rotation of serum globulin to be $-59.7°$. Dissolved in 0.2 per cent hydrochloric acid, the proteid is readily attacked by pepsin, and is gradually transformed into proteoses and peptone, while a small amount is simultaneously converted into an

*American Chem. Journal, vol. 14, p. 675.

insoluble anti-albumid-like body, which may be appropriately termed anti-vitellid. It is needless to say that in these digestion experiments the pepsin employed was a carefully purified preparation of the ferment, as free as possible from all traces of adhering albumoses, etc. It is unnecessary to weary you with details of separation and methods of purification; suffice it to say that two pepsin digestions on a large scale were carried out, 150 grams of the pure crystallized proteid being used in each digestion. In the first experiment the mixture of proteid, pepsin and hydrochloric acid was warmed at 40° for seventy-two hours. In the second digestion, a somewhat stronger pepsin solution was employed and the mixture was kept at 40° C. for ten days. The first point to be noticed in the results obtained is the relative formation of proteoses and peptone under these somewhat widely divergent conditions. The accompanying table brings out the differences with sufficient clearness:

Digestion.	72 hours.	10 days.
	Per cent.	*Per cent.*
Vitelloses	36	33
Peptone	63	66
Vitellid	1	1

These figures are to be considered simply as an approximation merely, since considerable loss naturally occurs in the separations. They illustrate, however, a feature of gastric digestion which I think has been already clearly demonstrated with other proteids, both in natural and artificial digestions, viz, that under no ordinary circumstances do we have a complete conversion of the proteid undergoing digestion into peptone. There always remain a residue of proteoses, which are very slow to undergo further transformation into peptone, even though the period of digestion be greatly lengthened or the strength of the ferment solution be greatly increased. The initial action may be rapid up to a certain point, beyond which further conversion into true peptone is slow and finally comes to almost a complete standstill. Thus, in the two experiments above quoted continuation of the digestion for ten days resulted only in the formation of 3 per cent more peptone than in the shorter digestion of seventy-two hours. It must not be assumed, however, from these figures that the ferment was wholly inactive during the greater portion of this second digestion period. This certainly was not the case, for analysis of the proteoses obtained from the two digestions shows plainly that in the longer and more active digestion the proteoses are represented by a far larger percentage of secondary proteose, the primary products being correspondingly diminished in amount. This is clearly shown in the following table:

Digestion.	72 hours.	10 days.
	85 Per cent.	*21 Per cent.*
Proto-vitellose	35	21
Hetero-vitellose	2	1
Mixed vitelloses (CH_3–COOH p. p.)	47	49
Deutero-vitellose	16	29
Total	100	100

These results, then, are fully in accord with the view that in digestive proteolysis we have to deal with a series of progressive changes resulting in the formation of a series of soluble and diffusible bodies known collectively as proteoses and peptones. Hitherto we have been wont to limit our ideas of the proteoses to the primary bodies proto- and hetero-proteose and the secondary proteose, known as deutero-proteose, each of these being considered as existent in both the hemi and anti form. A fourth body, known as dysproteose, is simply a coagulated form of hetero-proteose. The writer, however, has had for some time a growing conviction, based upon the

many results obtained in this field of work, that digestive proteolysis is still more complex than we have been wont to consider it. The proteoses may, perhaps, be compared to the many more or less isomeric dextrins formed in amylolytic digestion, a given proteose, for example, being considered not necessarily as a single substance but rather as a representative of a group of closely allied bodies representing different stages in the proteolysis. We have been led to consider the possibility of this view because of the apparent lack of agreement oftentimes noticed in the composition of a given proteose when repeatedly separated from different digestive mixtures. In other words, the composition of a given proteose appears to vary more or less with variations in the extent of the proteolytic change by which it has resulted; that is to say, the length and intensity of proteolytic action appear to exert a modifying influence upon the composition of the resultant proteoses. It was especially to test this point that the present experiments with pure crystallized phyto-vitellin were undertaken. In proteolytic digestion it has always been noticed when careful analyses of the products have been made that the proteid undergoing digestion loses carbon as the hydrolytic change proceeds, so that each successive product of proteolysis contains less carbon than its direct antecedent down to true peptone, the final product of gastric digestion, which latter body may contain two-fifths per cent less carbon than the mother proteid. Thus proto- and hetero-proteoses, as primary products, contain, as a rule, only a little less carbon than the proteid from which they are derived; while deutero-proteose, a secondary product of hydration, always contains still less carbon; and true peptone, the final product of the hydrolytic change, a still smaller amount. Now, whatever the conditions under which these several bodies are formed their general characters are always the same; their chemical reactions and general properties, so far as we are able to recognize them, are always essentially constant; but their chemical composition shows marked variation. Further, this variation is something more than a mere variation such as might be attributed to lack of complete purification, etc. It is a variation which shows a certain degree of constancy, pointing in a certain direction, and, if the results are to be trusted, indicates that the composition of a given proteose, as now defined, is variable within certain limits, the exact composition being dependent upon the length and intensity of the proteolytic action. This point is well illustrated by the present series of experiments. Thus, in the two digestions already described, both conducted under exactly the same conditions, excepting that one was continued for seventy-two hours and the other for ten days, and the latter with a somewhat stronger pepsin solution, proteoses of essentially the same general character were separated, but with the following variations in composition:

	C.	H.	N.	S.	O.
Vitellin	51.63	6.90	18.78	.90	21.79
Proto-vitellose, first digestion	51.55	6.73	18.90	1.09	21.73
Proto vitellose, second digestion	50.45	6.68	17.10	1.28	24.49
Mixed vitelloses, first digestion	50.85	6.68	18.94	1.10	22.43
Mixed vitelloses, second digestion	49.43	6.77	18.37	1.29	24.14
Deutero-vitellose, first digestion	49.73	6.73	17.97	1.08	24.44
Deutero-vitellose, second digestion	50.03	6.70	18.93	1.53	22.81
Peptone	49.40	6.77	18.40	.49	24.94

If this was the only series of results of this nature that we had to offer I should hardly think it worthy of calling attention to, but results along the same general line have been cropping out continually and to my mind they have some significance. Thus, the proto-vitellose separated from the two digestions shows a variation of 1 per cent of carbon, and it is to be noticed that the lower content of carbon belongs to the body resulting after ten days' digestion at 40°. C. Further, with the mixed proteoses, the acetic acid precipitate, or a mixture of proto- and deutero-vitellose, the same result is to be noticed. Further, in both instances the nitrogen likewise shows a diminution as an apparent result of the longer proteolytic action.

With deutero-vitellose and true peptone the final products of the proteolytic change there is less tendency for this variation in composition; it is usually more apparent in the primary proteoses.

I am well aware that these results are open to criticism; that it may be said they are the result of mere accident; that if they imply anything they testify simply to the general lack of definiteness of this class of bodies. But to this I answer that it is comparatively easy to obtain these bodies with like composition over and over again by simply keeping the conditions under which they are formed fairly constant. It is only when the conditions are changed; when the first-formed bodies are exposed to renewed ferment action that changes in their composition begin to appear, although the general characters of the bodies, the reactions on which their identification and separation depend, remain constant. Other forms of proteid matter have given these results and, now that they are likewise obtained with this, a purer form of proteid matter, we are convinced that they have some real significance, a significance that may be interpreted as furnishing additional evidence that the proteolytic process considered from the chemical standpoint is one of gradual, successive changes, resulting not only in the formation of a series of well-defined bodies such as the proteoses and peptone; but that these, especially the primary proteoses, may be represented by a class of semi-isomeric bodies showing only slight shades of difference yet each standing for a definite step in the proteolytic process.

CHANGES IN GANGLION CELLS FROM BIRTH TO DEATH FROM OLD AGE; PRELIMINARY COMMUNICATION.

By C. F. HODGE, Ph. D.,

Assistant Professor of Physiology and Neurology, Clark University.

Whatever may be true of the protozoa and certain of the lower metazoa, which multiply by fission, undoubtedly for all higher animals the process of growing old, of senescense, is a normal physiological process. It is manifested, probably, in all tissues, from the bones, which lose their animal matter; the muscles, which waste away; and the glands, which sclerose, to the brain, which becomes enfeebled, incapable of thought or will. Dr. Holmes may take exception to this last statement, and he has good right to; but for the general run of old men and old dogs that can not learn new tricks the above holds true. In fact, it is such shining examples as the one just named that urge to a physiological study of ageing that all may grow old as gracefully as Dr. Holmes.

Search should be made through all the tissues for the cause of somatic death. This cause may lie equally in blood, muscle, gland, and nerve; and the intricate interdependence of organs and functions which constitute the circle of an animal's life would support this view. My own previous work makes it expedient for me to begin the search with the nerve cell; and besides, there are reasons for believing that this element plays a prëeminent rôle in the determination of somatic life. It is true, muscle and nerve are often referred to as "master tissues" of the body. But muscle is certainly a poor sort of a slave to be called a master. Whenever bidden by a nerve impulse, it contracts. Otherwise it lies quiescent and fails even to nourish itself, shriveling in atrophy if cut off from its nerve supply. The relation of gland to nerve is in general similar; and thus the nervous system may indirectly determine the nutritive constituents of blood and lymph. It is a remarkable and significant fact in this connection that in the embryo the nervous system develops so far in advance of the other organs, and that a lesion here during embryonic life so often causes arrest of growth in corresponding parts of the body. It is not the place, however, to discuss the trophic influence of nerve centers.

In speaking of normal death and in searching among the cells of the various tissues for its cause, I refer, of course, to theoretically physiological dying. Where death is complicated with disease of kidney, or lung, or heart, examination is made of these organs and their pathology gives us the cause of death. Even here, it should be remarked aside, the real cause often lies behind the organ itself in the nerve centers which furnish it control. With man the process of physiological decline often reaches the stage of senescence, but rarely the point of actual death. The fact that it is a normal process renders search for its cause none the less legitimate and only enhances its scientific significance and interest.

The above may serve to indicate the point of view from which I have undertaken a study of the problem. The present paper can only be put forward as a preliminary communication, embodying a year's work in a field to properly cover which must require the united efforts of a number of workers for many years. At any rate a sufficient number of animals should be studied, in all tissues, to enable us to distinguish special from general results.

Changes in the walls of the blood vessels within the brain and spinal cord of the aged, as well as sclerosis of the nerve tissue itself, have already been described. Although related, these are aside from my present purpose, which is to confine attention entirely to intracellular phenomena. The exact question is, What differences in the cells themselves can be discovered by comparison of similar nerve cells from the young and the old? In this field Schultze* has attempted to prove that pigmentation of ganglion cells increases with age, and this has been associated with pathological pigmentary degeneration. Schäfer† opposes the idea of any such connection, maintaining that pigment everywhere in the body is evidence of functional activity and not of decay.

Observations which I wish to report at this time have been made upon the following material:

First, the cerebrum, cerebellum, cervical cord, and first cervical ganglia of a man dying of old age at 92 years. So far as could be observed or ascertained, cause of death was not complicated with disease of any sort. During the last two years he came gradually to require more and more sleep, considerably more in winter than in summer. At last it became difficult to awaken him for meals. Finally this became impossible and after six days of inanition respiration and pulse grew weaker and weaker and finally ceased without the slightest struggle or even movement to mark the point of death. The above-named parts were removed 11 hours post mortem, and were prepared by methods to be presently indicated.

Second, the first cervical ganglia of a male fetus killed by accident of birth.

Third, portions of cerebrum, cerebellum, and first cervical ganglia of a man killed by accident at the age of 47.

Fourth, superesophageal ganglia of 21 old honey bees prepared side by side with brains of the same number of young bees taken as they emerged from the brood cells.

In the human cerebrum at 92 years of age no pronounced abnormality has been detected by methods thus far employed. By the osmic acid-bichromate method of Ramón y Cajal, both as to size of cell and number of processes, neurons, and dendrons, everything appears normal. The alcohol-magenta, mercuric chloride, and long osmic acid methods show usual appearance of protoplasm, with considerable pigment, nuclei full and clear and nucleoli prominent. If degenerative changes are present, they do not involve a sufficiently large proportion of cells to strike one in the ordinary study of the sections. The cells of Purkinje appear considerably shrunken, both nucleus and protoplasm; though not more so than in normal daily fatigue. There are also 25 per cent fewer, by count, than in sections of cerebellum of the middle-aged man, cut at the same stroke of the knife. This difference may

* R. Schultze. Ueber Artificielle, Cadaveröse und Pathologische Veränderungen des Rückenmarks. Neurol. Centralbl. Bel. II, S. 529-536, 1883.

† Schäfer. The Nerve Cell as a Basis of Neurology; Brain. 1893.

not be abnormal. Most striking differences occur in the cells of the spinal ganglia. Possibly the most important of these is a failure of the nucleolus to stain with osmic acid in cells of the old man. Considering the rôle which this organ plays in processes of reproduction, and it possibly plays no less a rôle in subsequent physiological functions, this fact may have a wide significance. Coupled with this is the condition of the nucleus, considerably shrunken and with irregular, jagged outline. In case of fatigue the nucleus shrinks and at the same time grows dark. In the old-age specimens the nucleus has shrunken and remains light, not taking the stain more heavily than the cell protoplasm. Nucleoli are large and densely stained in corresponding cells of the fœtus, and nuclei are large, round, and clear, not a single one being at all shrunken or dark. Camera drawings of the two are shown in figs. 1 and 2. The protoplasm in the old man is seen to be largely filled with pigment and fat, both substances appearing black in osmic acid specimens, the pigment being yellow and the fatty masses being represented by large vacuoles in sections by the corrosive sublimate method. The cells of the fœtus contain almost no pigment at all.

The above comparison may best be expressed in tabular form as follows:

TABLE I.

	Volume of nucleus.	Nucleoli observable in nuclei.	Pigment, much.	Pigment, little.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Fœtus	100	In 53	.....	.....
Old man	64.2	In 5	67	33

It was not found possible to gain much light upon exactly the point in question from the brain of the man killed by accident. This was a disappointment; since it was hoped that it might furnish a specimen of human brain in prime of life not complicated by pathological conditions, something quite difficult to obtain. The man was, however, a confirmed alcoholic, and by the osmic acid method, upon results of which my comparisons were in the main founded, fully nine-tenths of the ganglion cells in cerebrum and spinal ganglia stained as black as fat cells, showing no structure whatever. Whether the alcohol habit has anything to do with this result remains for further experiment to decide. The rest of the cells stained darkly and were considerably filled with pigment and fat, but showed large, clear nuclei and normal nucleoli.

With the honey bee, experiments could be far better controlled, and results are accordingly more definite. The young bees were caught in the act of crawling out of the brood cells. They are at this time practically ready to begin their life work. The fact that in all cases the honey sac was found moderately distended with honey will serve to indicate a uniform nutritive condition. Old bees were chosen by "age signs," worn and frayed wings, abraded hairs, and general behavior. This last was of special use. When a hive is opened, all the able-bodied bees are alert and active in protecting the combs or in securing what honey each can carry. Here and there, generally off in some corner, you may observe a bee quietly humped up, taking neither part nor interest in the general commotion. Such a one is likely to bear the signs of extreme age. The experiments were made in August during a period of honey dearth, while the bees were "loafing," in order to obtain results as free as possible from complications with fatigue. This matter will require consideration further on. The young and old bees were beheaded, the front and side portions of the skull quickly pared away with a sharp scalpel so as to expose the brain, and both were placed in the same watch glass of 1 per cent osmic acid for two hours. From this they passed, with the old and young always in the same bottles or dishes, through the usual steps to hard paraffin, where young and old were cut side by side with the same stroke of the section knife. In no case were specimens to be compared separated in passing from the living bee to the microscope slide. While paring off the

scull caps I was struck by a remarkable difference in size between young and old brains. The young brains fill the skull so full that it is difficult to lift off the chitin without injuring the parts below. The old brains are shrunken into a flat cake filling not half the cavity of the skull. It is easy to observe this with the unaided eye. Reasons for the above will appear when examination is made of the sections. These were cut with a Minot microtome, new model, 2 and 6 μ thick. Sections of the 21 young brains appeared under the microscope as much alike as though they had been successive sections cut from the same brain. The nuclei are large and clear. They are, in fact, so large in proportion to size of cells that they often crowd one another into polyhedral shapes. This is shown in fig. 3, drawn from the antennal lobe of young bee No. 1. Protoplasm appears dense and evenly granular. In the old brains protoplasm is all but absent, being reduced to a few shreds and granules between the large vacuoles which fill the cell. The nuclei are shriveled in many cases almost beyond recognition. Here, too, as we found in the human ganglion cells, the nuclei in senescence decrease in size, but do not grow dark and granular as in fatigue. This general result is not so uniform for old as for young brains, and naturally so; because it is of course impossible to obtain old bees of uniform age. The age signs by which they were chosen are no more uniform than the appearance of the brains. The above description applies literally to the extreme cases; and not one of the old brains failed to show differences of the character indicated by which they could easily be distinguished from young brains. (Compare figs. 3 and 4.)

In addition to the above, the most noteworthy result furnished by the bees is that the cells are much more numerous in the young than in the old. A count of 22 groups of cells taken as nearly alike as possible in old and young give an average of 1 cell in the old to 2.9 cells in the young. In all cases the cells were fewer in the old. In a former series of experiments * bees were killed morning and night, in order to demonstrate, if possible, changes in brain cells owing to fatigue of a day's work. Differences in appearance of cells were found which could not be accounted for on grounds of daily fatigue, and it was then urged (p. 155) that the only variable which could account for them must be a difference in age. The present series confirms that opinion so strongly that in future no study of nerve-cell fatigue can be considered final until just allowance has been made for differences due to age. Daily fatigue in bees must be worked over again with this point in view; and just how far results as obtained in diurnal fatigue of birds may have been complicated by age can only be determined when changes due to aging have been studied in some one, at least, of this class. This brings us back to our first experiments, in which corresponding cells of the same animal were compared. Here no complication of age can have influenced results. It was demonstrated that in fatigue the cell protoplasm became vacuolated, the nucleus shrunk and came to stain more darkly, and the nucleolus showed a tendency to decrease in size, although this is not constant. Testimony from all sides points to the nucleolus and nucleus as the source of origin of the protoplasm. In extreme age we find protoplasm vacuolated in bees, pigmented in man, nucleus shrunken, but not dense, as in fatigue, and the nucleolus absent from a large proportion of cells in man. The nerve cells of the honey bee do not possess a sharply defined nucleolus like that of vertebrates. If anything of the kind exists in these cells, it must be represented by irregular granules, as indicated in fig. 3. These, as may be seen in fig. 4, are largely absent from nuclei of aged cells.

The nucleus being the source of rejuvenation for the cell protoplasm, the above would seem to indicate that age is of the nature of final fatigue, final, because the source of energy for the nerve cell has dried up at the fountain head. Decrease in number would intimate that the young bee commences active life with a full quota of nerve cells. Filling the skull as they do, it is difficult to conceive, since the

* Hodge. A Microscopical Study of Changes due to Functional Activity in Nerve Cells. Journal of Morphology, Vol. VII, Boston, 1892.

adult bee does not moult, how these cells can increase much in either size or number in subsequent life. To start with there is, in brief, a superabundance of cells which furnish the animal not only energy to maintain vital processes necessary to life, but in addition to this, energy for the performance of work. As the work of life is being performed, the cells, one by one, are worn out. A stage is reached when only enough cells remain to barely support processes requisite for continuance of life, no extra work being possible. Finally this number fails, and the functions of life must cease.

In the above I do not wish to be understood to insist that nerve tissue is of any more importance in relation to physiological dying than any other tissue. Just the position held by each tissue in this regard must clearly be determined by experiment.

The working out of age changes in the tissues of a series of animals is something which clearly requires, above all things, time for its consummation. The above is put forward in the hope that valuable material which might otherwise go to waste may be utilized in this connection. (Illustrations not furnished.)

A MICROSCOPICAL STUDY OF THE NERVE CELL DURING STIMULATION.

By C. F. HODGE, Ph. D.

EXPERIMENTS ON SPINAL AND SYMPATHETIC GANGLION CELLS OF FROGS.

The purpose of the present series of experiments is to observe continuously the process of fatigue in the nerve cell. Up to the present series my method has consisted in studying the cells at the end of a period of fatigue and only after the tissue had passed through the usual processes of preparation for the microscope. From the first it has been my desire to study the process continuously in the living cell. A report of former work upon the subject of changes in ganglion cells due to electrical stimulation and daily fatigue may be found in a previous number of the Journal of Morphology.*

Method.

At first an attempt was made to observe the cells in situ with circulation disturbed as little as possible. This was done by removing the viscera from in front and a portion of the spinal column, muscles, etc., from the back, tying all blood vessels, thus leaving the pleuro-peritoneum with its blood vessels and the sympathetic chain intact. Small frogs were used, but the large pigment cells in the pleuro-peritoneum itself, and especially along the blood vessels and sympathetic cord, made it impossible to get a clear view of the sympathetic ganglion cells. I was obliged to abandon the method. It thus became necessary to remove the ganglia from the body and free them from their pigmented capsules. In consequence of this the following method was adopted, and it has proved more serviceable than was anticipated. Special apparatus employed can best be understood in connection with a typical experiment. A pair of spinal or sympathetic ganglia is quickly excised from a freshly pithed frog. Each of these is placed immediately in a drop of normal salt solution on a "stage-electrode" of the following construction (fig. 1): A plate of thin clear glass (A), of shape indicated in figure and of a size to be conveniently clipped to stage of a Zeiss microscope stand, larger size, has two grooves cut in its under surface from margin to near center. These are made deep enough to conceal two fine platinum wires, which are cemented in them (B). A half centimeter beyond central

*Hodge. A Microscopical Study of Changes due to Functional Activity in Nerve Cells. Journal of Morphology, Vol. VII, p. 95. Boston, 1892.

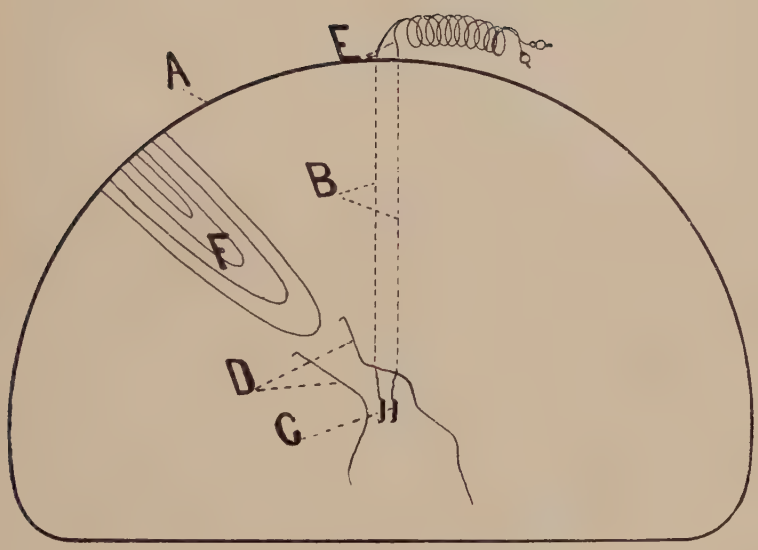


FIG. 1.—Microscope stage electrode.

A. Glass plate.
B. Two platinum wires laid in grooves on under side of plate and rising through plate to be exposed on upper surface to serve as stimulating tips at–
C. Exposed portion of electrodes.
D. Platinum wires to support cover slip.
E. Wires to induction coil.
F. Trough ground in glass plate to carry off stream of normal solution.

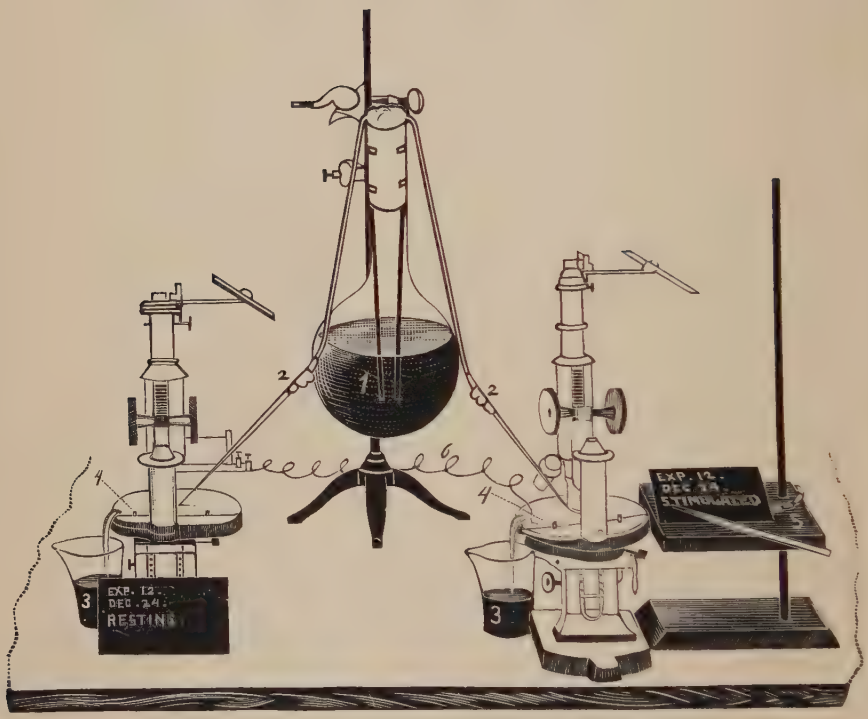


FIG. 2.—Setting of apparatus for ganglion cell stimulation.

1. Flask of normal solution.
2, 2′. Glass siphons which lead solution to edge of cover slip
3, 3′. Beaker to catch drip.
4, 4′. Stage electrodes in position.
5. Drawing stand to hold card at level of stage.
6. Wires from right-hand microscope to secondary coil.

end of grooves the platinum wires are brought to upper surface of glass through two needle holes about 2 millimeters apart. The ends of the wires are then bent down into needle-hole pits in the upper surface of the plate about 2 millimeters beyond the first perforations. Shallow grooves in the upper surface are made to connect the holes of each pair, so that the platinum wires come to lie half exposed on the upper surface of plate for a distance of 2 millimeters (C). They are then filed off level with surface of glass. This portion of the wires, of course, acts as the electrode, and the preparation is arranged so that either the ganglion lies between the electrodes or its nerve lies over them. The other end of each platinum wire is soldered to an insulated copper wire, which goes to a secondary coil. Two other platinum wires (D) support the cover slip. These, for convenience, are hooked into pits in the glass, and are so bent and adjusted as to direct the stream of normal salt solution over the specimen.

With the plan of this simple electrode understood, the remainder of the method may be seen at a glance at fig. 2. Each electrode is clipped to its microscope and a stream of normal salt solution is drawn from flask (*a*) by means of glass siphons (*b* and *b*), which end in finely drawn nozzles. These are placed at edge of cover slip opposite trough (F), fig. 1. The stream from (F) drips into beaker (*e*). Other parts of figure need no explanation. We now have, living in the same fluid, corresponding ganglia of the same animal. A group of cells as nearly alike as possible is sought out in each preparation and brought to center of field. A cell, or several cells in each, are measured and outlined with aid of camera, and then electrical stimulation is applied to one of the preparations and not to the other. Both are watched and at intervals measured and drawn. Two cameras, each attached to its microscope, were used at first (as shown in fig. 2). To render the two pictures more comparable, avoiding thus any difference in the angle of the mirrors, a camera was clamped to the eyepiece, with mirror firmly set, and eyepiece and camera were lifted together from one microscope to the other. Stimulation was interrupted, fifteen seconds' work alternating with forty-five seconds' rest, the primary circuit current being made and broken by a "Lombard clock interrupter." Four Daniel cells, supplying current of .2 ampere, were used throughout. The induction coil used was one of Krüger's (10305 U). Aside from the electrode and device for supply of normal salt solution, the apparatus was made as similar as possible to that used in my earlier experiments and fully described in the paper just cited. At end of desired time both control and stimulated ganglia were placed together in osmic acid and teased in glycerin for further study and preservation.

In all, 33 experiments have been made. These have varied in duration from fifteen minutes to six days. They were divided into a winter series, made between November 25, 1892, and December 24, and a summer series, made from June 14 to September 3, 1893. Since no marked difference in results has borne out this division, I have substituted for it a grouping of the experiments according to their purpose and nature. It is intended to give in the following table a condensed statement of the whole research. Each experiment bears its date, but for convenience of reference the numbers have been given to the experiments as they stand in the table. The time of day is written as an exponent of the date, and since all experiments were made during daytime, no designation of "A. M." or "P. M." is required. As in the previous work, interest centers chiefly about the nucleus. Change in this is expressed in percentage of loss or gain, using the original volume as 100 per cent. Time in hours and minutes from beginning of experiments is written as an exponent of the shrinkage per cent. Where several cells were watched, each bears its proper number throughout the experiment. Controls enter the table only in case some change is noted in them. No significant change in size of cell body was observed, hence their omission from table. Experiments 1 and 2 were made with cells of sympathetic ganglia. In all the rest the spinal ganglia were used.

Table of all experiments.

No.	Date.	Position of coil.	Normal solution used.	Shrinkage in volume of nucleus.
		cm.		
1	Nov. 26, 3. 45 ..	10	NaCl 0.65 per cent.	45 m., 33 per cent; 1 h., 33 per cent; 1 h. 30 m., 33 per cent.
2	Nov. 30, 11. 05 .	10	.....do	55 m., 52 per cent; 23 h. 25 m., 53 per cent.
3	Dec. 7, 12.....	10	.....do	3 h., cell 1. 52 per cent; cell 2. 64 per cent.
4	Dec. 16, 2. 25...	10	.....do	Cell 1: 20 m., 0 per cent; 3 h. 5 m., 20 per cent; 20 h. 45 m., 20 per cent. Cell 2: 20 m., 0 per cent; 3 h. 5 m., 20 per cent; 20 h. 45 m., 20 per cent; stimulus too strong, lost. Cell 3: 20 m., 0 per cent; 3 h. 5 m., 14 per cent.
5	Dec. 17, 4.....	10	.....do	1 h. 45 m., 53 per cent.
6	Dec. 20, 2. 55...	13	.....do	Cell 1: 1 h. 40 m., 56 per cent; 2 h. 40 m., 68 per cent; 3 h. 5 m., 74 per cent. Cell 2: 1 h. 40 m., 18 per cent; 2 h. 40 m., 32 per cent; 3 h. 5 m., 32 per cent. Controls shrunk not enough to measure.
7	Dec. 21, 9. 50...	13	.....do	Cell 1: 1 h. 25 m., 28 per cent; 23 h. 15 m., 54 per cent. Cell 2: 1 h. 25 m., 30 per cent; 23 h. 15 m., 45 per cent.
8	Dec. 23, 9. 30...	13	.....do	40 m., 30 per cent, control, 8 per cent; 1 h. 40 m., 42 per cent; 2 h. 40 m., 44 per cent; 4 h. 40 m., 62 per cent; 22 h. 40 m., 62 per cent; control. 8 per cent.
9	Dec. 24, 9. 45...	13	.....do	1 h., 18 per cent, control, 0 per cent; 2 h., 27.1 per cent, control, 11 per cent; 3 h., 40 per cent, control, 0 per cent; 4 h. 15 m., 65 per cent; 5 h. 15 m. to 7 h. 15 m., 68 per cent, control, 8 and 19 per cent.
10	Jan. 14, 10.....	13	.....do	30 m., 39 per cent.; 1 h., 44 per cent.
11	Jan. 15, 10.....	13	.....do	5 h., 30 per cent. Cell injured.
12	Jan. 19, 10. 30..	.....	.....do	No nucleus or nucleoli visible in cells. Not stimulated.
13	Jan. 19, 10. 55..	.....	.....do	Frog similar to one used in 12. No nuclei or nucleoli visible in any of the cells, although they appear clear and free from pigment. Stimulation applied and in 20 minutes faint outline of nuclei became visible. After 4 hours and 30 minutes stimulation, faint irregular outline of nuclei visible. No nucleoli to be seen.
14	Aug. 14, 2. 15 ..	10	.....do	30 m., 46 per cent.
15	Aug. 14, 5	13	.....do	30 m., 24 per cent; 1 h., 42 per cent.
16	Aug. 21, 11. 05 .	10	Ringer's solution	1 h. 20 m., 48 per cent.
17	Aug. 30, 10. 25 .	10	.....do	10 m., 35 per cent; 20 m., 58 per cent; 30 m., 61 per cent; 50 m., 65 per cent; 1 h. 20 m., 69 per cent; 2 h. 45 m., 74 per cent.
18	Aug. 30, 9	13	.....do	23 m., 23 per cent.
19	Aug. 30, 2. 22 ..	13	.....do	10 m., 26 per cent; 10 m., 42 per cent; 40 m., 51 per cent; 2 h. 45 m., 65 per cent.
20	Aug. 31, 9. 33 ..	13	.....do	12 m., 25 per cent; 35 m., 45 per cent; 50 m., 54 per cent; 1 h. 50 m., 64 and 54 per cent.
21	Sept. 2, 11. 10 ..	13	.....do	15 m., 22 per cent; 30 m., 37 per cent.
22	Sept. 2, 11. 45 ..	13	.....do	1 h. 30 m., 48 per cent.
23	Sept. 3, 10. 29 ..	12	.....do	30 m., 18 per cent; 1 h., 29 per cent; 1 h. 30 m., 43 per cent; 2 h., 43 per cent; 4 h. 44 m., 69 per cent.
			EXPERIMENTS WITH DISTAL STIMULATION.	
24	Aug. 5, 3. 30...	13	Salt solution....	15 m., 17 per cent continuous stimulation.
25	Aug. 13, 5.....	10	.....do	15 m., 33 per cent. Same cell as 24.
			EXPERIMENTS WITH CENTRAL STIMULATION.	
26	Aug. 13, 4. 40 ..	10	Salt solution....	15 m., 12 per cent continuous stimulation.
27	Aug. 5, 4. 45 ...	10	... do	15 m., 0 per cent continuous stimulation.
28	Aug. 13	10	.... do	15 m., 30 per cent continuous stimulation, ganglion almost touching electrode.
29	Sept. 2, 9. 45...	13	Ringer's solution	15 m., 0 per cent continuous stimulation.
30	Sept. 2, 10. 30..	13	.....do	15 m., 0 per cent continuous stimulation.
			EXPERIMENTS WITH POTASSIUM TARTRATE SOLUTION.	
31	Aug. 28, 10. 50 .	10	Salt solution 0.65 per cent, saturated with calcium phosphate + 0.1 per cent potassium tartrate.	20 m., 14 per cent; nucleolus moved about in nucleus with continuous change of shape, and finally fragmented and disappeared. Nucleolus of normal control was seen at first to change from crescent-shaped to round, in which condition it remained.
32	Aug. 28, 1. 36..	10	.....do	30 m., 39 per cent. Behavior of nucleolus similar to 29.
33	Aug. 28, 2. 45..	10	.....do	30 m., 30 per cent. Behavior of nucleolus same as in 29 and 30.

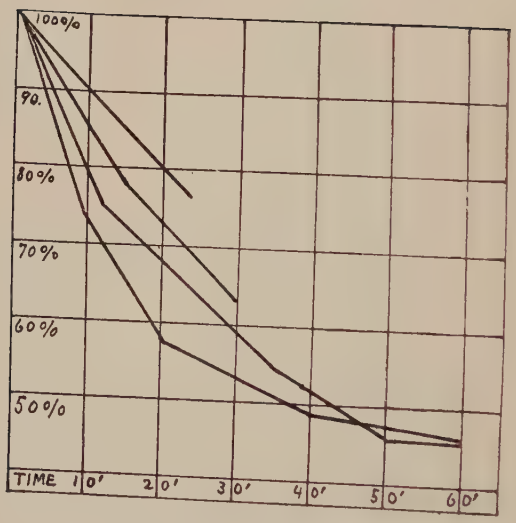


FIG. 3.—Curves showing shrinkage of nuclei in experiments 18 to 21.

The most striking feature of the table is perhaps its great irregularity, the lack of any apparent relation between amount, duration or intensity of stimulation, and effect in change of nucleus. This is in apparent disagreement with results of former work, in which a quantitative relation between stimulus and shrinkage of nucleus was evident. It is, however, easy to show that the lack of agreement is only apparent. In the former experiments we were dealing with definite amounts of stimulus given in the same way to corresponding nerves, which in turn led the stimulus to corresponding ganglion cells. The point to be emphasized is that the cells were in position in the body under practically the same conditions of blood supply and nutrition and in similar relation to the stimulus. In the present series the cells are removed from the body, placed in a stream of solution, which it is impossible to make equal to the different cells, and in an electric field, the intensity of which in any point it is impossible to regulate or even estimate. Taking these important variables into account, the evidence for quantitative relations between stimulus and effect is, possibly, as strong as we should expect to find it. The measurements from which the percentages in the table were computed were made long and short diameters of nucleus as usual, with no thought beyond accuracy of each measurement. Differences and similarities between different experiments may be seen more clearly by plotting the percentages in the table in the form of curves. This was done for all the experiments. Four of the most comparable of the curves are reproduced in fig. 3, drawn from experiment 18 in 21 minutes. Position of coil and solution are the same in these experiments, yet the course run by each in its fatigue is distinct, though similar in character. By far the majority of the curves are of the same general form. They show that the cell tires rapidly at first, then more gradually to a condition of fatigue, complete, at least, so far as our present method is able to indicate. This is also in apparent variance with curves derived from a former series of experiments, in which fatigue was rapid at first, then gradual, then more rapid again. A slight tendency to this form of curve is found in experiments 6, 8, 9, 18, these all showing slight secondary acceleration. Considering the circumstances of the two series of experiments, no correspondence can be expected. In the present series the cells are not living in a nutrient solution, but in a normal non-nutrient solution, which is able, in all probability, to carry off by diffusion the waste matters of the cell's metabolism. Consequently the nucleus shrinks more rapidly and also more continuously to a condition of complete fatigue. As more fully discussed in a previous paper, there are reasons for believing that cells in presence of nutriment carry on the processes of anabolism and katabolism at the same time. Under the conditions of our present experiments, anabolism is impossible, while katabolism is, possibly, unimpeded or accelerated. Note the slight shrinkage which occurs in a few of the control ganglia.

Shrinkage in nuclei of control cells probably occurred to a slight degree in all experiments where simple sodium chloride solution was used. It never reached the point at which the nucleus began to show indentations. In Ringer's solution, or in salt solution saturated with calcium phosphate, no change in this respect could be detected, even for long periods. This agrees in the main with recent work by Locke* upon the influence of so-called "normal" solutions on the form of curve of muscle contraction, salt solution making the curve higher than normal. A slight effect tending toward that produced by stimulation is no more than we should expect in transferring ganglion cells from blood to any normal solution. In experiment 9 the control nucleus takes a peculiar course. It is seen to swell slightly for the first two hours, then comes back to normal and continues to shrink, until in seven hours it has lost 19 per cent of its original bulk. I have, as yet, no adequate explanation for this case. It stands alone, so far as my observations go. Upon diluting a normal solution with distilled water, I have observed similar swelling of nuclei. This fact, however, throws little light on the present instance.

* Locke, Die Wirkung der Physiologischen Kochsalzlösung auf quergestreifte Muskeln, Pflüger's Archiv., Bd. LIV, S., 501–524, Bonn, 1893.

Experiments 1 to 23 were all made with the single purpose of observing changes which might occur in ganglion cells during stimulation. But few in this group require fuller statement than is already given in the table.

In experiment 3 the cells were kept under observation, at intervals, for six days. Camera drawings were made, at least one a day, during the whole time. Measurements were taken to begin with, and at the end of three hours. As the mirror of camera was moved, it is not possible to compute volumes accurately beyond this time. Measurements were omitted under the impression that camera drawings would serve instead. This necessitates a brief description by way of supplementing the table. The experiment was begun at noon, December 7, and during the first five hours the nuclei decreased in size and became irregular in outline. By the next morning, the nuclei had somewhat regained their rounded outline, though remaining small, and the appearance of both protoplasm and nuclei showed little or no change beyond the retraction of the protoplasm from capsule to closely envelope the nuclei. During the fourth day granules in protoplasm and nuclei appeared to be in violent commotion. My notes for this day contain the words, "cells alive with bacteria." An incrustation of salt had formed around edges of cover slip, in places. In washing this off with distilled water, a little ran under the cover slip, and the nuclei were observed to swell. It was expected that the "bacteria" would leave little of the cells to be seen next day. On the contrary, by the morning of the fifth day, all movement of granules had subsided and nuclei and protoplasm had regained, to all appearances, their former condition. Upon the morning of the sixth day, however, the nucleoli of two of the cells had entirely disappeared, and the outline of the nuclei in these cells could scarcely be distinguished. In the third cell the nucleus was visible, though faintly, and contained a small speck of still highly refractive nucleolus matter. On tapping the cover slip lightly to dislodge a mass of debris which had floated out so as to obscure some of the cells, they all flew to pieces and the experiment was at an end.

Experiment 4 also deserves a word of explanation. An attempt was made in this case to obtain, by showing the secondary coil to 0, the greatest possible effect in the shortest time. Contrary to expectation, however, no change could be observed at first. Very little occurred during the first three hours, and the nuclei remained round and clear during nearly twenty-one hours of this extreme stimulation. Three more experiments, not given place in the table, were tried with coil in same position and with the same result. Motile protozoa were next submitted to the same stimulation. Paramecia were found to be killed almost instantly. At least they showed no signs of movement after a few, less than fifteen, seconds' exposure to the current, and speedily disintegrated. Large vorticellæ were able to endure more; but after two or three exposures of fifteen seconds each, they invariably succumbed. A number of similar tests were made with gradually decreasing strengths of current, and it was found that with the secondary coil at 10, paramecia, although considerably startled, did not appear to be injured. No relation necessarily exists between strength of current injurious to paramecia and to frog's spinal ganglion cells; however, 10 centimeters was decided upon as the limit of stimulation for remaining experiments.

Experiments 12 and 13 are anomalous. In perfectly clear unpigmented ganglion cells no nucleus or nucleolus is to be seen. This is not peculiar to the June experiments, for even during the winter several cases of the kind occurred. They were, at the time, discarded with the note, "cells not clear, no nuclei visible." The two instances, 12 and 13, are too pronounced to leave unrecorded. They force upon one comparison with the apparently similar disappearance of the germinal vessicle in the ovum at maturation. The fact that on stimulation traces of nuclei but none of nucleoli became visible, is also of significance. But whatever this may be, is at present a matter for experiment rather than discussion. In subsequent experiments, 14 to 33, made upon young frogs, R. temporaria, which had just passed the tadpole stage, left nothing to be desired in way of clearness of nuclei.

FIG. 4.—Camera outlines of cell, nucleus and nucleolus in experiment 23 (Zeiss, oc. 6, obj. 4-mm., x 375.) Time is given in hours and minutes.

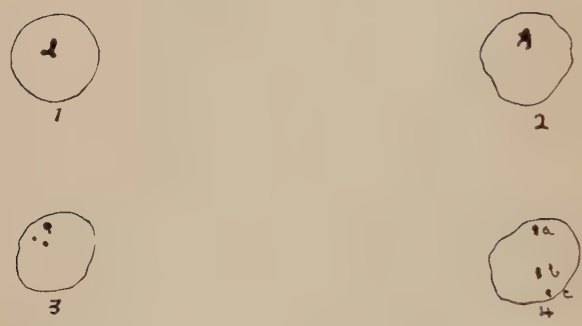


FIG. 5.—Camera outlines of changes in nucleolus in experiment 31 during 22 minutes stimulation in 0.1 of potassium tartrate added to normal solution, a — c occurred in 4 minutes. Zeiss obj. 4.0, oc. 6, x 375.

A fair picture of an experiment can hardly be given in a table or by curves. It requires a series of plates drawn from the living specimen. This has not been done, because I do not feel that my study of cell granulation and its changes during fatigue is at all complete. Hence, for the present, the following outline drawings, reproduced from camera outlines made during the experiment, may suffice. Fig. 4 represents experiment 23, [1] to [7] being successive drawings of the stimulated cell.

To begin with, we have a typical spinal ganglion cell, with nucleus situated eccentrically. The nucleus is clear, slightly oval in shape, but with perfectly even contour, as seen in optical section. After thirty minutes' stimulation, [2], fig. 4, the side toward center of cell has changed, the outline here having become faint and indented. In [4], the other side has begun to cave in, and so on to [7], where we see a shrunken, jagged nucleus [0], its original size. It has come to lie a little closer to the cell capsule, and the cell scarcely decreased in size to a measurable amount. To enter here more into detail would be to repeat a former description. The experiments are, in fact, repetition of former work under conditions varied so that we see continuously and in a single cell what we were able to find in a series of different animals and months of experimentation before. Placed in osmic acid, the nuclei retain this appearance, which fact completes the connection with former work done by the osmic acid method. It should be added, however, that the characteristic darkening of the nucleus as it shrinks does not occur in these experiments.

Considerable attention was directed toward studying changes in the granulation of protoplasm during stimulation. Some of the cells became lighter and clearer, while in others this was not so manifest. In experiment 3 the cell under observation contained several prominent oil droplets. During the first two hours one of these was observed to become smaller and smaller, and at last it disappeared. Two more, observed at first to be separate, were seen to have moved together and coalesced. Teased in glycerin, after treatment with osmic acid, the cell protoplasm is seen to be pervaded with large, irregular, light spaces, probably the vacuoles observed in sections. The entire cell is, however, too thick for such study. It was impossible also to detect indications of vacuolation in the living cell. During the whole time nucleoli were also subjected to closest scrutiny, in the hope of seeing possibly the movements described by Svierczewski,* and of gaining some light as to the function of this organ outside of strictly reproductive processes. While in normal salt solution or Ringer's solution no movement of any sort, or only slight changes of shape and position, such as are indicated in fig. 4, could be observed, together with a gradual decrease in size. Connected with this latter it was possible to make out granules in the nucleolus, which moved slowly about, and in several instances were seen to be extruded into the nucleus. Confirmation of the above was immediately sought in sections of spinal ganglia already in my possession, and was found in abundance in osmic acid specimens stained in safranin. The granules here were stained a brighter red than the body of the nucleolus, and several were found partially extruded. In this connection I may briefly refer to experiments 31 to 33, although they belong properly to a subsequent paper. Potassium tartrate was (1 per cent) added to sodium chloride and calcium phosphate solution, with a view of giving the cells a trace of potassium and more oxygen in case there was not enough accessible in the plain liquid. The somewhat unexpected result may be seen outlined in fig. 5. The different stages represented in (small type) 1–4 were actually observed and camera outlines made in twenty-two minutes. The movement of the nucleolus in this case had every appearance of being amœboid. The nucleolus of the control cell changed shape somewhat, but retained its size, whereas the fragments of the stimulated nucleolus had all dissolved in thirty minutes. Experiments 32 and 33 gave exactly similar results, except that the control nucleoli were not observed to move.

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* Svierczewski. Zur Physiologie des Kerns und Kernkorperchens der Nervenzellen des Sympathet icus. Centralblatt f. d. Med. Wissensch., Berlin, 1869, p. 641.

A number of the briefer experiments were made with the special purpose of testing upon frogs certain results which Vas * has recently reported from experiments upon the sympathetic ganglion cells of the rabbit. Among these results Vas describes a swelling of the cell and especially of the nucleus upon continuous stimulation for fifteen minutes, the electrodes being applied to the cervical sympathetic 3 centimeters below the superior cervical ganglion. The nuclei of these cells became swollen and clear, exactly the reverse of my results for spinal ganglion cells after a longer period of intermittent stimulation. It is of interest to note that this diametrically opposed result is obtained by stimulating the nerve in the reverse direction to that of the normal passage of the nervous impulse. Hence in these experiments stimulation was applied to the dorsal root between cord and ganglion.

Of the seven experiments under this head, 4 showed no change in the appearance of nucleus; 2, slight change, 7 to 12 per cent; 1, marked change, of about 30 per cent. All change observed was toward shrinkage, with no tendency to swell. It should be added, however, that the present method affords no adequate test of Vas's results, since (if stimulation the reverse way tends to produce swelling, and if this be anabolic in character) no anabolism would be possible in a non-nutrient solution. In the two experiments with slight change the ganglia were near the electrodes; in the one with marked effect it almost touched one electrode, so that the change produced was in all probability due to irrradiation of stimulus.

In the present series no attempt has been made to do more than test under new conditions the validity of previous work. A method has been devised by which a much easier and more complete and satisfactory demonstration of fatigue changes in ganglion cells may be made. Former work has found confirmation, with the additional result that the effect produced by hours of stimulation of a nerve in the body may be obtained in a few minutes by removing the cells to a non-nutrient solution and placing them between the electrodes.

In concluding I may call attention to the fact that with the above method we have a means of studying the action of any chemical substance, medical or nutrient, upon the nerve cell itself. With modifications for temperature, it may serve equally well for mammalian tissue. It is intended to make these the next steps in the work.

DISCUSSION.

Dr. Macallum.—Dr. Hodge's observations are extremely interesting and instructive. It would be interesting also to determine the micro-chemical changes that occur in the nerve cells. Lehenedl and Monti have shown that the cytoplasm of the nerve cell contains more phosphorus than the nucleus of the same, and if we could parallel Dr. Hodge's observation by observations with the method used by those observers we might gain a full history of the changes of the nerve cell under stimulation. Dr. Hodge's observations on the amœboid properties of the nucleolus under the influence of potassic tartrate solutions show that these bodies exhibit under certain conditions properties which are not usually attributed to them. The speaker himself observed in the gland cells of young amphibia the amœboid movement of the nucleolus, and regards this as a normal property. Bütschli found that drops of a mixture of salt, old olive oil, and albumin exhibited amœboid properties, and it is not surprising that such a body as the nucleolus, so closely connected and associated with the vital properties of the cell, should exhibit movement. It is more reasonable to believe this than to believe that because a nucleolus-like body exhibits movement as it does in certain cancer cells, that it is therefore a parasitic organism, a conclusion which some pathologists have adopted. As to the question whether pigment indicates decay or activity, Dr. Macallum thought that both views are partly true.

* Vas, Ferd. Studien uber den Bau des Chromatins in der Sympathetischen Ganglienzelle. Archiv. f. Mik. Anat. Bd. 40 S., 375, 1892.

Pigment is chemically melanin, an iron-holding derivative of chromatin, like hæmoglobin and as chromatin, as shown in the nucleolus, disappears in old age and activity, it is but natural to conclude that the abundance of melanin is an indication of past activity on the one hand and on the other of how far the cell has progressed toward decay. The nucleoli are reserve chromatin, which, in young and resting cells, is more abundant than in those of old age. This fact explains the disappearance of the nucleoli in the nerve cells of old age. With the diminution of the chromatin there must be a diminution in the number of cells holding it, and therefore Dr. Hodge's observations on the great diminution of the number of nucleoli and of the nerve cells themselves is in accordance with the speaker's observation on other cells. Dr. Hodge has done work whose value in understanding certain psychological phenomena is inestimable.

ON THE RESPIRATORY CENTER IN THE MEDULLA OBLONGATA.

By J. GAD.

The number of muscles taking part in every normal respiration is very large; larger than would generally be supposed. It is an old and unfortunately widespread idea that the diaphragm alone is sufficient for the carrying out of a normal inspiration. It is, indeed, possible by suitable sections of the spinal cord to reduce an animal to the necessity of ventilating the lungs by means of the diaphragm alone and the degree of ventilation in such an animal will be found, at least at first, not to be below the normal. If, however, the movements of the thorax be observed, it will be seen that it now neither widens, as in the thoracic type of respiration, nor remains of unaltered diameter, as in the so-called diaphragmatic type, but that the lower and lateral regions are drawn sharply inward. And when the exposed diaphragm is watched, it is seen to descend much farther, i. e., to work much harder than before. The diaphragm requires therefore, even with the apparently purely diaphragmatic breathing of the rabbit, the continual assistance of the thoracic muscles, simultaneously stimulated with corresponding intensity, if it would not be exhausted by excessive and unsuitable exertions.

We see from this example very clearly the need for the proper coördination of a great number of respiratory muscles, whose motor roots are distributed over a great part of the spinal cord from the fourth cervical to the twelfth dorsal segment. The necessary number of functional combinations of respiratory muscles is, however, far greater, as is shown by observations which can not be entered into here. On them is based the view that a normal respiration can only take place when the intensity of stimulation of each respiratory muscle is brought into proper relation with the others. The immediate innervation areas of these muscles reach from the nucleus of the nervus facialis in the medulla oblongata down to the lumbar plexus. The simplest way of getting such a coördination is seen in the case of the muscles of the eye. The nerve cells which supply the muscle fibers of the rectus internus are found partly in the nucleus of the oculo-motorius and partly in the abducens nucleus of the opposite side, so that when the left internus acts together with the right, as in bringing the point of regard closer, a different portion of its muscle fibers are engaged than when it acts with the right abducens, as in glancing to the right. Every stimulus which reaches the right abducens nucleus finds here motor nerve cells not only of the right abducens, but also of the opposite internus, and every time the right abducens is stimulated the left internus is also stimulated in corresponding degree. In this example the coördination of two muscles is accomplished by bringing together a part of their motor nerve cells. This will not serve in the case of the respiratory muscles, neither the inspiratory nor the expiratory, for we have seen that their motor nerve cells are distributed through a long series of segments.

If we take for granted that similar ends are reached in similar ways, we may here use to some advantage our knowledge of the coördination mechanism of a certain group of movements in the frog. A very important coördinated movement in the frog is the taking of the spring position, for only from this position can he make the spring which is often his one chance for life. The spring position is assumed by bending all the joints in the hind limbs, and the motor nerves of the flexor muscles carrying out these movements have their origin in the great motor ganglion cells of the anterior horn in a series of segments of the distal portion of the spinal cord. Evidence has been brought forward that in the proximal portion, from the fourth spinal segment upward, the coördination of the muscles taking part in the assumption of the spring position is effected through small ganglion cells of the posterior horn. Anatomically expressed, the axis-cylinder processes of the small ganglion cells, together with their collaterals, stretch to the motor ganglion cells of the flexors of the hind limbs and embrace these cells with their terminal branches. Each individual ganglion cell in the first category can in this way occasion a simultaneous excitation of a number of distant motor cells, and acts as a coördinating mechanism for them. We may say that the elements coördinated by this apparatus are subordinate to it, or that the latter is a preördinating apparatus for these elements. The small ganglion cells, which coördinate the flexor muscles for the assumption of the spring position, are placed together in the proximal part of the spinal cord. They are connected in space and have a common function, and for this reason may be termed a "center," and more particularly a "coördinating center for the flexor muscles."

The combination of motor nerve cells, in the nucleus of the facial nerve or of the vagus or in the individual spinal segments, which supply the muscles taking part in respiration may be called the "respiratory muscle center," and what we have learned concerning the flexion center in the frog warrants us in assigning to some complex of nerve cells the function of bringing the bulbar and spinal respiratory muscle centers into orderly, related activity. Such a coördinating "respiratory center" would be sought, according to the usual experience concerning the location of higher coördinating functions, not in the mammalian spinal cord, but in the more proximal portions of the central nervous system. Legallois, indeed, was able to show rabbits which continued to breathe regularly after the removal of the cerebral hemispheres together with the pons as far down as the vagus roots. Death followed the removal of more distal parts, a circumstance attributed by Legallois to destruction of the vagus roots. Flourens, however, who pointed out that vagotomy was not immediately fatal, ascribed the result to the extirpation of his *nœud vital* at the point of the calamus scriptorius. It is certainly true that the destruction of a comparatively circumscribed area in this region will cause a sudden arrest of respiration and speedy death, and this spot may therefore be picturesquely called a vital knot; but that this place is not the seat of the respiratory center, as defined above, has recently been shown by me and Marinesco. Brown-Séquard in France, and later, Langendorff in Germany, have long contended that the result of Flouren's experiment is not to be explained by the non-stimulating removal of the only place of origin of the respiratory excitation, but by the strong stimulation of an inhibitory path.

To the authors just named the respiratory muscle centers are places where the respiratory excitation develops under the stimulus of the blood, but where it may be repressed by the nervous excitation transmitted by the vagus, trigeminus, and other nerves which play a reflex part in the normal regulation of the respiration. Langendorff based his opinion on highly interesting experiments of Rokitansky's on new-born animals, which Langendorff was able to confirm, namely, that such animals, if they are previously given a little strychnine, continue to breathe spontaneously some time after decapitation. It appears to me, however, that these experiments can not be made of general application with regard to the functional

independence of spinal respiratory muscle centers in fully grown animals, for it has often been shown that the spinal cord of newly born and of lower animals possesses a greater independence of the higher parts of the central nervous system than in the fully grown, in whom alone the changing conditions to which the respiration must be adjusted have reached that complexity which makes the mechanism of its regulation so interesting a problem. The logical development of the idea of the essential independence of the spinal respiratory muscle centers must lead to experiments which were made by none of the original representatives of this idea, but were first done by Wertheimer. Wertheimer took fully grown or nearly grown dogs, carried them with long-continued artificial respiration over the immediate consequences of section between cervical cord and spinal bulb and noted the behavior of the animals when artificial respiration was stopped, three-quarters to two hours later. Besides other movements, his animals showed also such as caused a circulation of air in the trachea and sufficed to prolong life three-quarters of an hour without artificial respiration. Not much weight, to be sure, is to be laid on the last circumstance, for the animals must have become cold-blooded under his method, and may have acted like hibernators, who also can live with a minimal circulation of air in the trachea. The form of the movement was the important question and concerning this four experiments of my own have given me an opinion. I used young, scarcely grown dogs and began artificial respiration directly after but not sooner than the stopping of spontaneous breathing after the separation of the spinal bulb. In order to avoid excessive cooling of the animals, I experimented on warm summer days and looked out for plenty of covering.

About an hour after the operation the animals behaved like admirable reflex preparations; when they were raised by the neck they attempted to lift the head, showing that shock had passed off; the heart beat was strong; the rectal temperature indeed had fallen. When the artificial respiration was interrupted, the animal lying upon its side, it continued at first to lie quietly, then began irregular movements in which thorax and abdomen took part, but not to a pronounced degree. From time to time the diaphragm contracted independently and alone, while between times muscles of inspiration and expiration showed a highly disordered activity. These could not possibly be termed coördinated respiratory movements, such as an animal that has not been made cold-blooded needs to make in order to preserve life. These phenomena were repeatedly observed in the same animal and showed themselves in essentially the same way in all four animals. I got the impression that the spinal respiratory muscle centers did all they were capable of doing after separation from the respiratory center; they fell into activity with the increasing accumulation of carbon dioxide, just as did the spinal nerve cell groups which call forth other movements, for example those of a limb; this activity also found rhythmical expression and could be increased reflexly like the movements of a limb; but there was no indication present that the spinal respiratory muscle centers possess a specially strong sensibility towards the stimulus of the blood. This perhaps might be due to the cooling—scarcely to be avoided in this method of experimentation—so that I can give these experiments no deciding power in any direction. The idea of the dependence of spinal respiratory muscle centers on a coördinating respiratory center in the spinal bulb was not strictly demonstrated, but, on the contrary, was not shaken; rather strengthened.

The efforts to localize the respiratory center in one narrowly circumscribed place in the spinal bulb have (as is known) led only to contradictions. Flourens, Longet, Scheff, Gierke, Mislawsky, and Hohn, have each given a different bilaterally symmetrical area whose destruction on both sides should be followed by permanent stopping of the respiration. This result is indeed to be had at each of these spots, if a coarse section is made, so that the surrounding tissue is much shaken by the instrument itself or by hæmorrhage following the section. The areas lying superficially, for example that given by Gierke, as often fail to show the result

when the section is made without shock to surrounding parts and when the hæmorrhage happens to be absent. In such experiments, however, a transient interruption may occur, but is indeed to be referred to the stimulation of an inhibitory path, for it passes off without any treatment. Too little attention is paid to the danger of being deceived by stimulation of inhibitory paths in the attempts to localize the bulbar respiratory center, although Brown-Séquard pointed out this danger long ago, a service for which we may give him credit without assenting to his conclusions.

Finally, it results from these several experiments that the attempt to confine the respiratory center to a narrowly circumscribed seat has no prospect of success. It must, indeed, excite surprise that the possibility of doing this should have been held to be so important; in fact, far more important than the demonstration of nerve cells at the place in question. We could not, indeed, expect that nerve cells which carry out a defined coördination should be irregularly strewn about in the central nervous system; on the contrary, they should be united in a well-defined anatomical system. There need, however, be no limit to the separation in space of the elements of this system, except that set by the common requirements of the cells of the center in respect of their food and their blood and lymph supply.

It was not probable that further progress in the solution of the problems we have been discussing could be made without a method by which extensive extirpations could be carried out, step by step, in such a way that each individual procedure should cause the smallest possible inhibition stimulus; that each further procedure should be made only after the effect of the stimulus of the preceding had died out, and that each successive act should permit as sure a localization of its effect as the previous one. I had seen that cauterization by laying on small pieces of blotting paper just saturated with nitrate of silver fulfilled the conditions of the above-mentioned method and I had often, before my classes, thus eaten holes in the medulla oblongata of rabbits, which included all the places given as the seat of the respiratory center, without the respiration stopping. But time was lacking for the systematic employment of the method and I was accordingly much pleased when Mr. Marinesco, who had been present at one of these demonstrations, declared his willingness to investigate the matter in my laboratory. Mr. Marinesco learned first to do the fundamental experiment, which had to be learned less on account of the requisite nicety of manipulation than to acquire a conviction of the absolute necessity of going very slowly, step by step. In these preliminary experiments Mr. Marinescu found a still better method of extirpation; burning by means of glass pearls the size of a pin's head, made by melting the end of a fine glass thread. These glass pearls are very light, and thus all pressure, all shock, and all bleeding are avoided, and the operation field is always quite clean and clearly visible. And this procedure also makes much easier the interpretation of the sections of the suitably hardened tissues in respect of the extent and the boundaries of the extirpation.

The long continued exertions of Mr. Marinesco furnished us a great number of preparations from animals who either had continued to breathe in spite of extensive extirpations in the spinal bulb, or whose often inhibited and as often recurring respiration had finally ceased after the last slight extension of the extirpation. I lay the most weight on preparations from animals in whom the extirpation was done only on one side. Such animals breathed on uninterruptedly and sufficiently with the uninjured side. They lost by far less heat than in the Wertheimer experiment, because artificial respiration is avoided and the division of the medulla, even in deep extirpations, does not take in too large a part of its cross section. When in such animals a unilateral extirpation causes the respiration to stop on the operated side and there is no return during hours of observation, in which the animal is meanwhile breathing sufficiently with the intact side, the conclusion is certain that the effect of an inhibition stimulus has passed away and that the phenomena remaining are purely the expression of a loss of function. We have had frequently the opportunity of observing such animals. The unilateral breathing may with a

little practice be recognized with a fair degree of certainty, even with unopened abdomen. We finished the observation, however, by opening the abdomen, after time enough had passed for the effect of the inhibition stimulus to have disappeared, and determining with all certainty and by direct inspection of the diaphragm that the respiration was one-sided and that the passive half of the diaphragm did not become rhythmetically active even when the nostrils were closed by pressing them together. As asphyxia comes on, indeed, even this portion of the diaphragm may be drawn into the widespread irregular clonic convulsions. Observations of this sort on rabbits, cats, and dogs of different ages have fully persuaded me of the incorrectness of Brown-Séquard's, Langendorff's, and Wertheimer's views; the spinal respiratory muscle centers are not, in my opinion, relatively independent of the bulbar respiratory center but, on the contrary, are wholly dependent on the latter in their functional activity.

Although a transient disturbance of the respiration follows even a narrowly circumscribed and careful extirpation at most points on and beneath the floor of the fourth ventricle, yet a difference is to be noted. After some extirpations, as soon as the effect of the inhibition stimulus has passed off, the respiration comes back as strong as ever; but in others a noticeable weakening of the respiration remains even when it does not amount to positive failure. The areas giving the latter result lie in the formatio reticularis, whose nerve cells, therefore, are at least in part in relation to the bulbar respiratory center. In human anatomy, as is well known, the median part, or formatio reticularis alba (from the hypoglossus root to the raphé), is distinguished from the lateral formatio reticularis grisea. In man, and also in the rabbit, many more nerve cells are strewn through the lateral than through the median part of this formation, while in other animals, for example the cat, the number of nerve cells in the median part is very large. Corresponding to this, extirpations in the cat between the hypoglossus root and the raphé, when sufficiently deep and long, seriously impair or wholly stop the breathing, while in the rabbit the formatio reticularis lateralis must be removed in some extent in order to finally stop the respiration.

That the stopping of respiration after removal of the respiratory parts of the formatio reticularis was not due simply to the section of intra-central conducting paths leading from a more proximally situated respiratory center, but was the result of the removal of cellular elements influencing the respiratory rhythm, was shown by stimulation experiments on rabbits. In order to make a circumscribed electrical stimulation in the depths of the tissue we used very fine insect needles, which were covered to the points with a thin coat of varnish. These were united with the secondary coil of a Du Bois Reymond inductorium by means of very thin, soft, flexible conducting wires and a friction key. At the selected place the needles were passed close together through the floor of the freely exposed fourth ventricle into the bulb. The places which we desired to stimulate lay at such a depth that the needle electrodes were sufficiently fixed by the tissues through which they had been thrust, and the thinness and softness of the conducting wires permitted the needles to follow every movement of the animal, without the slightest displacement in the wound. In by far the greater number of cases the introduction of the needles and their continued presence, so long as the current did not flow through them, caused no alteration in the respiratory curve written with the respiratory volume writer (aëroplethysmograph). In two animals, however, very interesting attacks of coughing were observed, each attack being preceded by an interval of quiet, and it was found later that exceedingly minute hæmorrhages had taken place into the substance of the formatio reticularis lateralis. The electrical stimulation was made with the secondary coil as far from the primary as possible, and while the respiratory curve was being written with the aëroplethysmograph.

The first results which appeared with the smallest effective stimulus were seen when the needles were in the formatio reticularis lateralis, and only then, and con-

sisted of an inspiratory change in the breathing, namely, a quickening of the respiratory rhythm. Electrical stimulation below the point of the calamus scriptorius, and especially further distal (but still at a sufficient distance from the phrenic roots to prevent their excitation by the very weak current we were using), also affects the respiration. Here were observed, even with the weakest stimuli to which the respiration is capable of reacting, only tetanic contractions of the inspiratory muscles, on which were superposed the respiratory movements in their previous frequency and depth. Here, therefore, we have to do only with the cerebro-spinal motor conducting paths from the respiratory center to the spinal respiratory muscle centers, and this holds essentially true for the nœud vital also, while in the former case, where alterations in rhythm were observed, we must suppose that nerve cells were in action, and these nerve cells must belong to the respiratory center itself. The descending motor conducting paths were localized by Schiff in the lateral columns of the spinal cord. Mr. Marinesco was able to confirm this statement by the use of his method of progressive cauterization. He made this extirpation on one side between the first and third spinal root, and we considered the path in question wholly interrupted when the respiration on the same side did not return after an hour's interval nor in dyspnœa (the diaphragm being exposed for inspection and the animal continuing to breathe with the uninjured side). Mr. Marinesco was able to give the situation of this lateral path more exactly: In the processus reticularis, or lateral column at the base of the anterior horn. This is very satisfactory, for the reason that the bulbar continuation of the lateral column is to be sought in the formatio reticularis, whose cells are concerned in the function of the respiratory center. I hold this result to be indeed specially satisfactory, because the demand that a center subserving a definite function shall be a demonstrable group of nerve cells, for example, a group like the nucleus of a motor cerebral nerve, appears to me to rest on a preconception wholly without foundation. A coördinating mechanism of the highest order for such an extensive motor apparatus as that for respiration requires too large a number of nerve cells to make the realization of such an idea possible. All that can be demanded is that the nerve cells which subserve the function of the respiratory center shall be so arranged that they may be brought into relation with the respiration without conflicting with the histologically grounded conception of the systematic structure of the central nervous system. It is exactly here that the coincidence between the localization of the spinal path and the bulbar cells becomes so satisfactory.

There are physiologists who refuse all conceptions of a respiratory coördinating mechanism founded on an anatomical basis. A representative of this school (Langendorff) has recently expressed his views on this question as follows:

"By respiratory center should be understood the sum of the individual centers of the respiratory nerves, which must be conceived as united in a physiological union."

The fact of the common harmonious working of nerve centers widely separated from each other and supplied with blood under different conditions can not, however, be explained by the existence of a fixed chain of ideas in the head of a physiologist. In order to reach a scientific explanation, from which we are, indeed, still very far off, we must make an earnest attempt to get a definite idea of an anatomical connection between these centers which can serve as a basis for exact physico-chemical conceptions. Only such hypotheses can point the way to fruitful experimentation, and only such (not metaphysical dicta) can be matter for scientific discussion. An hypothesis permitting such discussion has been recently advanced by Exner and Grossmann. They also believe that they can do without a coördinating center which shall preördinate the respiratory muscle centers. Grossmann attempted to separate the bulbar respiratory muscle centers (facial nucleus for the respiratory movements of the nose and vagus nucleus for those of the glottis) from each other and from the spinal respiratory muscle centers by successive sections. He believed

he could establish the law that so long as any two of these centers were in connection they continued to functionate, but that each ceased to functionate as soon as it was completely isolated from the other.

Grossmann found that a section between the facial nucleus and the vagus nucleus stopped the respiratory movements of the nose, while those of the glottis and thorax still continued. He found further that a section between the vagus nucleus and the spinal cord stopped the thoracic movements, while those of the nose and the glottis continued; and, finally, he observed, on the other hand, that the movements of all three, nose, glottis, and thorax, ceased after two sections were made, the one between the facial and the vagus nucleus, the other between the vagus nucleus and the spinal cord. These experiments led Exner and Grossmann to the conclusion that the motor nerve cells of the various respiratory muscle centers must be united with each other by nerve conducting paths in such a way that each of these nerve cells communicates its excitation not only centrifugally to the muscle fibers dependent on it, but also within the center (intracentral) to the nerve cells of other respiratory muscle centers. Against this hypothesis is to be urged that the only test which the authors' experiments have undergone from other hands has failed to confirm in the most important particulars the observations on which the hypothesis is based. Frederic and Bienfait declare that they have seen the respiratory movements of the glottis continue after complete isolation of the vagus nucleus by section between vagus nucleus and facial nucleus, as well as between the vagus nucleus and the spinal cord, while the movements of the nose and the thorax stopped. This announcement is the more worthy of attention for the reason that after the above-mentioned sections have been made only the vagus nucleus remains in connection with the respiratory center demonstrated by Marinescu and me, in the formatio reticularis. But a serious mistrust of the Exner-Grossmann hypothesis can be justified even without a repetition of their experiments, for their hypothesis is grounded on the assumption that the motor ganglion cells can send an impulse in two directions.

Each motor cell possesses, as a rule, only one axis-cylinder process, and we know with certainty that the excitation is sent out of the cell by the way of this process. Impulses reach the cell, in all probability, by means of protoplasmic processes, and we know no histological difference between the protoplasmic processes that justifies us in selecting some for afferent and others for efferent impulses. That the cell would receive and send out impulses by the same path appears improbable when the classical experiment of the centripetal stimulation of the severed anterior spinal roots of the frog is called to mind. The fully demonstrated power of nerves to transmit impulses in two directions requires that the impulse arising from this stimulation should reach the motor nerve cells. As, however, it is known that the stimulation has no visible effect, the impulse can not have been transmitted over intracentral conducting paths. It is most probable that it does not pass the motor ganglion cells or, perhaps, does not even enter them. These reflections, indeed, rest on too uncertain a basis to themselves overthrow the hypothesis in question, but they at least point to experiments by which it may be tested. The hypothesis was born of section experiments and must withstand the test of stimulation experiments. If the Exner-Grossmann hypothesis is correct the isolated stimulation of a single respiratory muscle center should strengthen the respiratory movements depending on the remaining respiratory centers. If our conception of a preördinating respiratory center in the formatio reticularis is correct a narrowly circumscribed stimulus can influence in the same way, respiratory muscle centers lying far apart from each other only when the stimulus reaches the formatio reticularis.

Mr. Arnheim undertook the experiments in my laboratory in Berlin. We first devised a method for writing the respiratory movements of the nose on the kymographion simultaneously with the respiratory volume curve. When the stimulation experiment described above was repeated with this method, it was seen that when

the points of the two needle electrodes were passed into the formatio reticularis lateralis the quickening in the frequency, which we already know to be a certain indication of a minimal, i. e., barely effective, stimulation, was not limited to the respiratory movements of the thorax, but those of the nose were influenced in the same way. This result would not oppose the hypothesis under examination, provided it is accepted that our stimulation current reached the vagus nucleus. We ourselves believe that this possibility can be excluded with certainty, but it is difficult to furnish evidence that will convince others of this.

The above-mentioned result of the minimal stimulation of the processus reticularis in the proximal part of the cervical cord, consists in an increased tonus of all the thoracic muscles of respiration without any alteration in the frequency and depth of the individual respirations, a fact that was interpreted by us to mean that we had to do here not with a center, but with an intracentral motor path. This path might lead from the facial nucleus through the vagus nucleus to the spinal respiratory muscle centers (Exner-Grossmann), or might connect over respiratory center with the spinal respiratory muscle centers. According to the Exner-Grossmann hypothesis we must expect that the stimulation of the path would influence the nasal and the thoracic breathing in the same manner. The experiment, however, shows very decidedly that this is not the case.

As the stimulus increases to the point at which the increased tonus of the thoracic muscles of inspiration is produced, and alteration indeed appears also in the nasal movements, but is of quite another character and differs especially from the reaction of the thoracic inspiratory muscles in that it outlasts the stimulation. This and other of its remaining peculiarities characterize it as a reaction to a painful stimulation, which reaction appears always much earlier in the nose than in the thorax. We have never seen an increase of the tonus of the inspiratory muscles of the nose caused by stimulation of the spinal respiratory path, and we believe, therefore, that this path connects our respiratory center in the formatio reticularis with the spinal respiratory muscle centers, and that its excitation produces a visible effect only at one end of the path. An analogous path must exist, according to our conception, between the respiratory center in the formatio reticularis and the facial nucleus. The result of the stimulation of this path must be limited to the nasal movements. In fact, we have succeeded, with the aid of the needle electrodes, in finding places at the distal end of the facial nucleus whose stimulation to the effective point causes only increased tonus of the nasal muscles, in which the thoracic muscles do not participate.

The existence and meaning of this path may fortunately be still more clearly shown by a combination of the stimulation and the section experiment. It is well known that Martin, Booker, and Christiani have found places in the neighborhood of the Aqueductus Sylvii, at which different and well characterized reactions in the breathing can be produced. However slight are the reasons for calling these places "centers," after the example of their discoverers (they are probably only points in an important conducting path), the phenomena described by the authors named can always be reproduced with certainty. Christiani's "Inspiration center" has especially helped us to instructive reactions in the study of the more distal respiratory centers and paths. These reactions have a very clearly marked character, the same both in nasal and thoracic breathing. If an unilateral section is made between the facial nucleus and the vagus nucleus and the Christiani "center," stimulated on the opposite side, the nasal and thoracic reactions do not appear, while on stimulation of the injured side they appear as before. It follows from this experiment that we have to do here with crossed paths, and that the influence which the "center" exercises on the facial nucleus is not transmitted to it by the shortest path. If this were the case only those sections which are proximal from the facial nucleus would prevent the reaction. As distal sections also do this, the impulse can not pass by the shortest way, and an explanation of the circuitous

path is required. An explanation indeed can at once be given on the basis of our conception that all impulses, which affect all the different parts of the respiratory motor apparatus in common, reach them only by the agency of a coördinating respiratory center, which is preördinating to all respiratory muscle centers. The experiments recently made by me in association with Mr. Arnheim, as well as those first described (Gad and Marinesco), show that the seat of this center is the formatio reticularis lateralis. Our efforts to define the upper boundary of this center were at first not wholly successful, but we are now able to state that the center does not reach up to the facial nucleus, basing our statement on the previously mentioned result of the stimulation immediately distal from the facial nucleus. We see that this stimulation influences only the nasal breathing, and does not, as does the stimulation of the respiratory center, affect the nasal and thoracic breathing at the same time and in the same way. We have made good progress towards giving the preördinating respiratory center a definite place among objective things.

DISCUSSION.

Dr. Reichert said that the paper was one of considerable interest to him because his work is a practical demonstration of what Dr. Reichert has taught for years to the students in the medical department of the University of Pennsylvania, i. e., that the various motor nerve centers which are concerned in the complex coördination movements of respiration are undoubtedly governed by a pre-coördinating center.

Dr. Beyer, discussing Professor Gad's paper, said that the highest credit was due to the Professor for his work on the innervation of respiration; the formatio reticularis was always considered among nerve anatomists and physiologists as a very dark knot. Its connection, therefore, as a preördinating center of respiration is to be welcomed very heartily.

AUTOMATISM IN NERVE CENTERS.

By SAMUEL WOLFE, A. M., M. D.,

Clinical Professor of Nervous Diseases in the Medico-Chirurgical College, Philadelphia (formerly Professor of Physiology).

The so-called stage of rest in any physiological unit should be considered when regarding its total functional activity. This stage in the nerve cell must be continually influenced by impressions on the peripheral nerve endings sending impulses over fibers, which impressions arise in the external world, within the body from similar causes, and as the result of metabolic processes in the various tissues. The intimate connection by fibers of all the nerve cells makes it probable that no function of the cell is independent of impressions arising outside of the immediate cell concerned, hence not automatic in any absolute sense. A stability which prevents activity independent of excitation transmitted through a fiber is essential to the normal condition of most of these cells, and most probably of all of them.

INNERVATION OF THE VENA PORTA.

By FRANKLIN P. MALL. M. D., of Chicago, Ill.

It has been known for a long time that when the splanchnic nerve or cervical spinal cord is irritated the arterial pressure rises. During the irritation of these nerves it has also been noticed that the smaller arteries of the mesentery as well as others contract. The mechanical explanation of the rise of the arterial pressure was therefore quite simple. When the volume of the blood in the arteries, as well

as that thrown from the ventricle, is taken into consideration, it is at once seen that the simple contraction of some of the smaller arteries is not sufficient to explain the rise of arterial pressure after splanchnic irritation. It has been found that when the aorta is tied just below the left subclavian artery (and the femoral artery opened to prove that the arterial pressure is reduced to zero), irritation of the splanchnic nerve causes a decided rise of pressure in the carotid artery. Moreover, it is found that with the aorta open or closed splanchnic irritation causes an increase flow of blood to and from the heart, thus showing us that the real cause of arterial pressure is due to an increased amount of blood being thrown into the aorta. A similar rise of pressure can be produced by injecting a quantity of fresh blood either into the jugular vein or into the carotid artery. In a dog of average size splanchnic irritation causes an increase of about 100 c. c. of blood to be thrown into the aorta. Transfusion of the same quantity from another animal causes an identical arterial curve.

The first and most important experiment is the proof that when the splanchnic or the cord is irritated the vena porta contracts, often completely emptying its lumen. That this is not primarily due to a contraction of the smaller mesenteric arteries is proved by the fact that the contraction of the vein is most marked when the pressure in the abdominal aorta is reduced to zero. Moreover, with the aorta open and the vena porta closed, it is quite easy to cause the portal pressure to exceed that of the arterial by splanchnic irritations. We therefore conclude that the rise of arterial pressure, after splanchnic irritation, is due in great part to an increased quantity of blood being thrown from the heart; this, in turn, is caused by the contraction of the veins, and especially the vena porta and its branches. (*See* Archiv. für Anat., und Physiol., Paynol, Abt., 1892.)

In the demonstration to be made a ligature staff is applied to the aorta just below the origin of the left subclavian, and on the splanchnic is armed with an electrode. The portal vein is exposed, and after the artery is closed the splanchnic is irritated. The portal vein will contract and the arterial blood pressure will rise.

HIBERNATION AND ALLIED STATES IN ANIMALS.

By WESLEY MILLS, M. A., M. D.,

Professor of Physiology in McGill University, Montreal, Canada.

In a paper read on this subject before the Royal Society of Canada in 1892 I made reference to the views entertained in regard to the winter sleep of a number of animals, which will, however, be omitted from this paper in order to shorten it. My own studies were conducted chiefly on our American marmot or woodchuck (*Arctomys monax*), and of these I now give some account, together with details of some cases in man of hibernation or an allied state, one of these being, I think, about the most remarkable on record.

The object of my investigations being to ascertain not only the nature of the winter sleep, but the character of its variations under a changing environment, especially as regards temperature and meteorological conditions generally, I kept the animal in different rooms of the houses in which I dwelt successively through the creature's lifetime, and also in different parts of an outhouse in which my dogs, fowls, etc., lived. It would take up too much space and prove rather wearisome to attempt to reproduce here the records which I have kept in detail. It will be both more practicable and more profitable to give the general results of studies on this one specimen for the four years during which he lived, and then refer to the unexpected result of the study of another specimen during the past winter.

I think the following life periods were recognizable in the specimen I had under observation: (1) A period characterized by either drowsiness or sleep or profound torpor, lasting from about November to April; (2) a period of perfect wakefulness immediately following, during which the animal was emaciated, in poor coat, and with a general low vital capital, lasting for some weeks; (3) a period of improving condition, with good health and a desire to get free, which latter was also noticeable in the preceding period; (4) a period of maximum weight and vigor, with perfect coat and an abundance of fatty tissue. But little need be said about any of these life periods except the first. During the second the emaciation increased rapidly at first on waking, and was equally marked by voracious feeding. The meaning of this will be referred to later. It is plain that the organism entered on its long period of diminished vitality with a large stock of reserve material, and it is equally clear that this was drawn upon to the full.

I now turn to the peculiarities of the sleeping or torpid condition. I have characterized the first period as one of drowsiness, or sleep, or torpor, because there are subdivisions of the first period, during which the animal was found in a condition that was characterized by drowsiness, and no more; again, it was plainly only sleeping, while again it was as profoundly torpid as it ever became. The period of most profound sleep was never reached all of a sudden, but was preceded by the two states referred to above. Moreover, as the depth of winter approached the sleep became more profound, and the reverse with the approach of spring, so that we might represent the depth of the sleep by a rising followed by a falling curve with a rather long flattened top. During the whole of the first period the animal nestled in the straw, with which he was always provided, and when he was most profoundly unconscious but little of him could be seen often, so completely was he covered. Another important matter. The amount of food consumed was directly proportional to the depth of his sleep. Not only did he eat less frequently, as a matter of course, but the quantity taken at one time was less. Occasionally when fully hibernating he would awake to fall asleep again, merely after gathering the straw about him a little closer, and not eat at all. His cage always being supplied with food, there was no doubt about his ability to provide himself when so inclined. His excretions were also in proportion to the amount of food consumed, and especially to the depth of the sleep. The less he ate, and particularly the more profoundly he slept, the less were his evacuations when he awoke. He never befouled his bed, but always left it to void urine and fees. During the period of mere drowsiness the animal would be awakened by a gentle rustling against its cage, and even when asleep a noise would always arouse it; but when in a torpid condition it could not be thus aroused, but might be handled without being brought to the natural condition, though handling and much less disturbance always caused movement—a phenomenon to be discussed later.

In the spring of 1891 my woodchuck came out of his winter sleep in a very emaciated condition, and this, as usual, increasing after his awakening, he was in a doubtful state; but the case was soon decided against the animal in consequence of my servant having left him for some time fully exposed to the sun's rays. An autopsy revealed the fact that the animal (a male) was the subject of tuberculosis of the lungs, though possibly but for this exposure he might have lasted another year.

Through the kindness of Mr. R. F. Rorke, an undergraduate in medicine of McGill University, I became possessed of two specimens of the marmot in the latter part of the summer of 1891. One of these was very large and in fine condition, and his escape soon after arrival has been a frequent subject of regret by me, as I hoped to be able, not only to continue the observations, but to make them comparative, as it was my intention to keep both under the same conditions, in fact, in the same cage. But the curious part remains to be told. Though I kept the remaining woodchuck under exactly the same conditions as the animal I had so long had, he did not hibernate for an hour during two winters, though he drowsed and slept enough.

It has been generally considered that the hibernating condition of animals was dependent above all else on the temperature of the surrounding atmosphere. My experiments on bats seemed to warrant this conclusion, for whenever the temperature reached the neighborhood of 45° F. to 40° F., the other conditions being favorable, my specimens began to hibernate. It was also true that my woodchuck was in the deepest sleep during midwinter, when the cold is greatest. Whether a bat could be put into a state of torpor during summer by exposing it to a lowered temperature I do not know. However, Marshall Hall maintained that the diurnal sleep of the bat ("diurnation") was exactly the same phenomenon as the winter sleep. The same writer maintained that hibernating bats always awoke when the temperature fell below freezing point, and his observations showed that the temperature of the animals was always a few degrees above that of the surrounding atmosphere. Probably Hall is correct in the main, for my bats when the temperature sank during the night much below freezing were always found dead in the morning. Whether they awoke first or simply passed from torpor to death I do not know. However, for the marmot I can assert positively that this rule does not hold, for frequently the water was found frozen in the apartment in which the animal was kept, yet he was undisturbed. Nevertheless, I came to the conclusion that this exposure is injurious to a hibernating animal, and that it had something to do with the poor condition in which my specimen was found in the spring of the year in which he died.

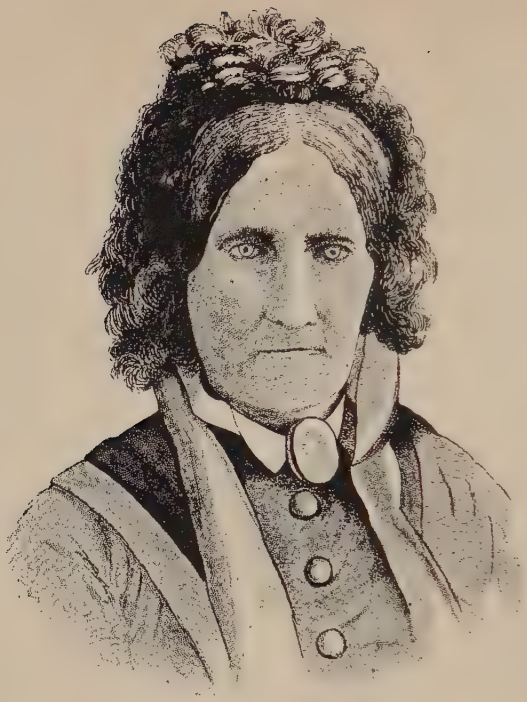
Before discussing the true nature of the phenomena of the winter sleep, I call attention to certain cases of allied nature. Such frequent references as we find to the hibernation of swallows deserve some consideration. It is also stated that in Scotland sheep have been found alive after being buried for weeks beneath the snow; and Dr. Frank Miller, of Burlington, Vt., reported when a student, to the Society for the Study of Comparative Psychology, at Montreal, that hogs had been found alive after being accidentally imprisoned below the surface for several weeks; longer than it seemed possible for them to survive under ordinary circumstances, so that it would appear they had been in a condition of hibernation, or some such state.

Turning to the human subject: We have all read of instances in man of "suspended animation" or "trance." The case of fakirs in India having been buried alive, exhumed and resuscitated after months is attested by such evidence as it is difficult to set aside, however hard to credit. Mr. D. W. Ross, a student in medicine of McGill University, has gathered the facts of a peculiar case in so far as they are now obtainable. The individual in question was known as "Sleepy Joe," a farmer by occupation. He was married and had several children, one of whom, a girl, had the same drowsy appearance as her father. This man would sleep almost constantly for several weeks, awakening, however, to attend to nature's calls and to take food. He would at times awake more fully and then set to work, whether it was day or night, and almost incessantly labor as if to make up for lost time. He was rather weak mentally, but appeared ashamed of his sleepy tendencies, which seemed to get worse as he grew older. He lived to be about 60 years of age.

Dr. Aug. Robinson, of Annapolis, has kindly given the following notes of a unique case:

John T., son of a pensioner, is now about 62 years old. When he was 28 years of age his father committed suicide by cutting his throat in a fit of insanity. Before his father's death John had shown symptoms of melancholia. He would sit by the hour over his father's cobbler's bench laughing and talking to himself and working himself into a frenzy, fighting imaginary foes, and going into immoderate fits of laughter. I can not ascertain, after much inquiry, how long this condition of things lasted before he lapsed into his present state; but this much is certain, for the last thirty years or more, about the end of September every year he falls into a deep sleep or stupor, and, as his present condition is a fair sample of the manner in which his winters have been passed since he was first attacked, I will describe him as I found him on Monday, December 10, 1888, and repeat what I was told by his friends regarding his attack this autumn:

About August 31 Jack went to bed after eating his evening meal as usual, without exhibiting anything out of the common in his manner or otherwise, or giving any



SUBJECT IN HEALTH.

SUBJECT IN A STATE OF LETHARGY.

reason for the supposition that he was out of sorts in any way. On the following morning he did not get up, nor has he shown any more vitality than any sleeping man up to this time. His sleep is very quiet, without any stertor; indeed, it is as calm as that of a child. Twice in every twenty-four hours he is taken up, a person supporting him on each side, holding a vessel for his convenience. He knows enough to voluntarily empty his bladder. The urine is high in color and scant in quantity. About 11 o'clock every night he seems to show rather more life than at any other time, and advantage is taken of this to pour a little thin oatmeal gruel, beef tea, or soup down his throat, he opening his lips to allow them to do so, and slowly swallowing it. He only takes a very little each time, and if urged to take more simply keeps his mouth shut. About once in every thirty days, not exactly at regular intervals, during the evening generally, the family will hear a peculiar chattering noise. They never take any notice of it, for they know it is Jack going down to the outhouse to empty his bowels. He then returns to his bed and sleeps. He knows enough to throw a quilt over his shoulders at such times.

At the time of my visit I found his temperature 96° F.; pulse 60, regular, though not strong; respirations 14, easy and quiet; skin cool. A pin stuck into his arm caused no apparent change, and he might be pinched until black and blue without its causing him the slightest uneasiness.

My first visit to Jack was about twenty years ago, when I first came to live and practice in this vicinity, and it came about in this way. Of course there was a talk about the new doctor and what he could do, so I was called to see this queer case. I got all the particulars from the friends and neighbors, and what means had been tried by other doctors, and then I promised to try what I could do. On the following day I went again, accompanied by my brother, also a physician. We took with us a good galvanic battery. One of the handles was placed in each hand and bound closely to the fingers with wet bandages. We then put on the full power of the instrument. Poor old Jack was out of bed in an instant, and I shall never forget his look of astonishment and horror as he yelled out, "Damnation, what's that?" I can also well remember my own feelings of satisfaction and complacency when the natives congratulated me on my success in this, my first case. I walked off as if saying to myself, "I knew I could do it." Well, Jack remained awake about three days and then I got a message that my patient was off again. I went up and tried the battery a second time, with only the effect, however, of making him open his eyes and grunt out "Eh," in a querulous manner, and after looking about him for a half hour or so, he lapsed into his former condition. Next day I again tried the battery, but without the slightest effect, so I gave it up as a hard case.

This is all I have to say about this singular object, except that, of course, he becomes very thin and haggard before he rouses finally in the spring, and he does not fairly waken until the end of May or first of June. During the summer months Jack does exactly the work he is told to do, but he must be told over again every day; for example, if desired to bring the cows from pasture, he will do so, but will not milk them until told to, nor will he turn them afield again without being desired. He does not seem to know what to do next, even though the same routine is carried out every day. An exception, however, must be made in one respect. He does not require to be told when dinner or tea time arrives, and is blessed with an excellent appetite. Jack is always ready for his food, and is not particular about quality, so that quantity is there. He will talk quite rationally on any subject when spoken to, and recollects distinctly most of the incidents of his childhood. He will hold animated confab with the cows, dogs, trees, wheelbarrow, or any other object which happens to be in his way, and may be noticed sometimes lecturing a tree for some time, breaking out occasionally into uproarious fits of laughter.

When visiting in 1890, Dr. C. K. Clarke, superintendent of the Asylum for Insane in Kingston, he happened to make reference to a peculiar individual known to a few as "the sleeping woman." It at once occurred to me that her case would prove a study of great value if it could be carried out, and I suggested to Dr. Clarke that he endeavor to supplement such facts as we could learn and such observations as we were able to make by a joint visit to the subject of this peculiar condition by a careful study of the case. He succeeded much beyond my expectations in doing this, and has published the results of his investigations in the American Journal of Insanity for October, 1891, under the title, "A case of lethargy," and from that paper I extract the principal facts in regard to this case, which is so remarkable that it may be well to state them somewhat fully.

Several seasons ago I heard that there was a patient who had been in a trance for years, and from time to time word was brought to the effect that the condition still persisted, and that all efforts to rouse the woman were without result. A little more

than a year ago I obtained permission to visit the patient, but was not allowed to make any extended examination. On entering the room I found a thin, old woman in bed, apparently fast asleep. Her respirations were irregular, and varied much during the visit (lasting almost half an hour), running all the way from 24 to 44 per minute. The pulse quickened in a marked way during my stay, and ran up from about 80 to 120. The woman had her eyes half closed, and to all appearances was oblivious to everything that was going on. The nurse gave many details regarding the patient, and made a number of statements, some of which I shall repeat in a few minutes. Many of these statements we were able to verify at a subsequent period; others were undoubtedly inaccurate. Before going into details regarding the every-day life of this case of lethargy, as we saw it, perhaps it would be well to give a brief outline of the history of the patient. Unfortunately, it has not been found possible to get as many important facts as could be desired in connection with this history; but great care has been taken to eliminate all doubtful points. The patient was born in 1820 or 1821, and when she came under observation was almost 69 years of age. The neurotic history was pronounced on "both sides of the house," evidence going to show that her father had suffered from melancholia. A reliable person states that the father died from "softening of the brain"—possibly general paresis. The patient's mother was subject (a member of the family states) to attacks of partial loss of reason, which could only be cured by change of air and surroundings. It has not been possible to get an accurate account of these attacks of "partial loss of reason." The patient's early history is not well known, but it has been stated on good authority that she was "peculiar," and in childhood complained of some head trouble that caused her to keep her hair cropped short. She was married when very young, probably when 17 or 18 years of age, as she was but 21 when her third child was born. Three years after the birth of her last child she was noticed to undergo a change in disposition and acted "strangely." She could not be depended on, was untruthful and whimsical, and worried a great deal about trifles.

It is from a subsequent period (three years later) that the history of this case must be dated. The son, the youngest child, says:

"The first recollection that I have of mother's sickness was when I was 6 years old. My little sister had died, and I was just recovering from an attack of scarlet fever when she was taken down. I think the attack was caused by grief over sister's death, and overexertion and want of rest. I do not remember how long she was sick at that time, but I recollect that her left side was completely paralyzed, and that after a time a strong liniment was used, which partially removed the paralysis, and when she went to the country for several weeks she came back well. The second time that she was taken sick was when I was 12 years old. She felt poorly for some time, and was then taken with fits, or convulsions, which lasted for, I think, three days, having sometimes four or five in an hour. She was confined to her bed for, I think, about two years, in very much the same condition as at present. I do not know what curative means were employed, but she gradually improved a little, and was again sent out into the country, where she seemed to recover. She enjoyed pretty good health for about six years, but had to be very careful; she never drank tea or coffee, and always had to have the hair on the back of her head cut short. About this time her father was taken sick and we moved into his house to take care of him. This seemed to affect mother and after a short time she was again taken with fits and soon went into her former condition. During this sickness, which lasted about two years, she used to sit up a great part of the time and appeared to be perfectly conscious. She knew father and those who waited on her; used to call me her boy, but appeared to be in a sort of a stupor most of the time. She was again sent into the country, and came back well. Then ensued a brief interval of about two years, during which time she was in fair health, but was again taken down as before, and was sick for nearly seven years. During part of this time she was very low and we watched day after day at her bedside expecting each day would be the last; but she again rallied and gradually her bodily strength and reason returned to her. She was well for about five years, when she seemed to be taken with a low fever and gradually went down to her present condition."

Such is the son's account of the case, and from it we learn that the history of nervous trouble dates back at least forty years, and the inference is that the first indications of lethargy then made their appearance. The details of the conditions that existed during the different attacks are almost entirely wanting and it is unfortunate that we are left almost completely in the dark regarding the nature of the convulsive seizures that occurred. Subsequent history would lead us to believe that these were in all probability hystero-epileptic in origin. About the year 1862 the patient fell into a state of lethargy that lasted for seven years or more. The condition was not one of complete unconsciousness and, although the woman appeared to sleep almost continually, occasionally she would wake up for a minute or so at a time and converse in a rational manner. It is not possible to make more than general statements in regard to these attacks, but it is beyond doubt that the

conditions were not identical with those that characterized the last attack. Evidently the condition of lethargy was not so profound. The announcement of the death of a warm friend was the immediate cause of her awakening. The return to even an approach to a normal condition of health was a very gradual process. She was lachrymose and childish for some time, and could not use her limbs properly for months; in fact, had to learn to walk again.

During the period of wakefulness that now ensued—seven years or more—the patient, to a certain extent, interested herself in the affairs of every-day life. She went about the house; but was very quiet and did not seem able to concentrate her mind on anything. Her memory was markedly deficient, and she seemed astonished to find people and places changed, and could not realize the fact that she had been asleep for such a long time. When waking up from her long sleep one of the first requests made was for beer, and, strange to say, the same want was expressed many years after when arousing from a subsequent attack.

About thirteen years ago the patient gradually passed into the condition in which we saw her. At first she spoke occasionally, but in a childish manner, and often made a request for meat and potatoes, invariably using the following words: "Meat and potatoes; a plate all full up to the top."

Before giving the details of the case as we saw it, it will be well to repeat, in a general way, the statements made by the nurses who had the care of the patient before she came to the asylum: She seems to exercise a certain amount of discrimination regarding her food and will eat enormously or not at all and when her appetite is not lost does not seem to know when she has had enough. Her diet is made up of minced meat, potatoes, soft toast, milk, etc., and she is particularly fond of meat and potatoes—in fact will not touch anything until meat and potatoes are provided. She does not like sweet things. When not suffering from diarrhea she eats three times a day. She eats as much as any healthy, active woman of her age. She objects to nauseous drugs and endeavors to push the spoon away with her left hand. The attitude during the day is quite different from that assumed at night, and the patient undoubtedly sleeps more soundly at night than during the day. In the daytime her legs are extended; at night drawn up. In the daytime she is put either on her back or right side, at night on her left side, and remains in this position until morning without moving; in fact she can not roll over. She will not settle down for the night until a drink of cold water is given. In the daytime, sometimes for an hour or so at a time, she appears to be nearer a condition of consciousness than at any other time. This occurs generally after breakfast, but she has to be roused for her meals. When heavy coverlets are put on the bed, she attempts to shove the blankets off with her left hand, apparently preferring to be very lightly covered. The eyes are three parts closed during the day and completely closed at night. The face sometimes becomes flushed. She never speaks and, in fact, has spoken but once in eleven years or more and that was quite recently (1890), when she said, "I am not asleep." Her appetite has been better since she has been in the long sleep than it was before and she eats things she would not touch when awake. At least once during the present attack she has, unassisted, got out of bed and there is reason to believe she has done the same thing several times, but not within three years, as her physical condition renders it impossible. Several times the nurse fancied the patient was moving about the room at night, but for some time could not actually prove that such was the case. At last, however, a fall was heard in the middle of the night, and the patient was found lying fast asleep at the bottom of the stairs, down which she had fallen. During the present attack she has fasted on several occasions, and once went fifteen days without food. It must be remembered that the nurses were speaking of the last attack and at a time when the patient had been in a state of lethargy for more than eleven years.

In September, 1890, I saw the patient with Dr. Clarke. This was my first, but Dr. Clarke's second visit. We found the patient, an old woman, in bed. She was lying on her back with her eyes half closed. Her face when we first entered was somewhat flushed and respiration rapid. When respirations were closely observed it was noticed that they were most irregular and at times ceased for several moments. They averaged 22 per minute. Pulse was 104, fairly strong and regular; arteries almost free from rigidity. Axillary temperature, 98.6°. The nurse stated that ordinarily the patient's bowels moved but once in three days, but latterly she had developed a tendency to diarrhea and since that had evinced a sense of discomfort until the bowels were relieved. This sense of discomfort was evinced by whining like a dog. Ordinarily she would not give any indication that she wished to relieve herself, but the presence of the bedpan would excite the reflexes. She does not soil the bed. The statement of the nurse in regard to the amount of urine passed every day was that a little more than half a pint would be a fair average. A physical examination of the patient was made. The left foot was drawn as if there were a contracted tendo-Achillis: right foot drawn down, but not in such a marked manner as the left. Marked rigidity of the right knee and leg; left leg and knee not rigid.

Right ankle easily moved; left rigid. Patellar reflexes absent. Tickling the soles of the feet did not cause any evidence of sensibility. Each great toe was drawn under the second toe, this condition being especially marked in the left foot. When the soles of the feet were tickled it was thought that the respirations were slightly deepened, but on account of the irregularity of the breathing it was difficult to determine this point and it was considered undecided. Patient's hair gray; nails healthy and not abnormally brittle. Facial reflexes better than reflexes in any other part of the body. Orbicular reflexes good even with air: at the same time it was noticed that flies crawling over the face did not excite the reflexes. Pupils responsive to light. Small bedsores found on hips and evidence of former deep-seated bedsores plainly visible. While we were present the nurse endeavored to arouse the patient and tried to get her to take some food. A protest was made (whining), the patient winked for a few moments, and then went off to sleep again. Bread was put in her mouth, but remained there without any effort being made to swallow.

On October 9, 1890, the patient came under Dr. Clarke's care, and a series of observations of the most complete character was made. The patient, a thin old woman, apparently not weighing more than 60 pounds, was carried into the infirmary from the ambulance, and placed in bed. She was asleep and did not seem disturbed by the jolting to which she had been subjected. Her temperature was 97.2°, pulse 107, and respirations 20. Efforts were made to arouse her, but without avail. Friends stated that she had been in her present state of lethargy for more than eleven years. Her eyes were half closed, and it was found almost impossible to get her to swallow anything. Next morning her temperature was about normal: pulse 117, respiration 18; still asleep with the eyes half closed, as she remained nearly the whole time she lived.

She was under observation from October, 1890, until February, 1891, when she died. In these four months she was closely watched and until the last week of her life gave little indication that she had the slightest knowledge of the fact that she lived. She would remain in any position in which she was placed in bed, and if not fed would undoubtedly have died without making any sign that she required or desired food. Her temperature was almost invariably subnormal, sometimes falling to 95°, although occasionally it would rise to nearly 102°, without any cause that could be determined. Her appetite was capricious, although she undoubtedly had decided likes and dislikes in regard to food. She preferred beef and potatoes to anything else. The process of eating was very slow, and sometimes it would be more than an hour before she could finish a meal. When she drank anything milk was evidently preferred. She was very clean in her personal habits, and never soiled the bed. The quantity of urine passed was very small, not averaging more than one-seventh of normal. The bowels moved but seldom, sometimes only once in six or seven days. It was possible to rouse her for a moment or so, to the extent of making her open her eyes, but beyond this she would give no indication of consciousness, and went to sleep again immediately. Her legs were nearly always drawn up, although when the patient was admitted it was stated that she always straightened her legs at night. Her feet were almost invariably very cold and the hands sometimes so. Occasionally her eyelids would tremble and quiver, just as they will in a patient suffering from hysteria. Generally when much bothered she would for a few moments make a sort of whining protest. The facial expression was quiet, almost deathlike, under ordinary circumstances, but sometimes when undergoing examination an expression suggestive of pain would appear; at the same time it is questionable if pain was really experienced, as the heart and respirations did not show the least disturbance. A large amount of food for one so frail was consumed in a day, although on some occasions the appetite was completely lost. Sometimes when suddenly disturbed she would start nervously, and her hands would tremble. Trained Nurse Osborne, who was with her very constantly, seemed to think that there were times when she was nearer a condition of consciousness than at others and as this statement was also made by the former nurses, possibly it is correct. Occasionally she would push down the bedclothes with her hands and the history of the case would go to show that heavy coverings were always objectionable. Nearly every day she was propped up in a chair for half an hour. This did not seem to have any effect on her general condition.

The account of her last days are interesting. Early in February, 1891, a marked change took place in the patient's condition. Diarrhea developed, and the woman was evidently suffering pain. On the 4th of February she was undoubtedly awake, and in the evening spoke in a hoarse whisper asking for a sour drink. This was the second time she had spoken in thirteen years. On the morning of the 5th of February again asked for a drink, yawned twice, and fell asleep again. In the afternoon was again awake, fed herself in an awkward way, and in the evening spoke again in a natural manner. I sent for her friends, and they endeavored to get her to take notice of them, but she did not appear to know them, and went to sleep as usual. The trained nurse's notes for the next few days are as follows:

February 6.—Will feed herself with bread or anything dry. Hand shakes too much to use a cup or spoon. Will ask for anything she wants, but will not speak at any other time. Always uses her left hand.

February 7.—I was called in about 4 A. M., and found her lying on the floor; she would not speak, but from all appearances no one had touched her; she had evidently gotten out of bed herself. At 9:30 A. M. she was cold and very pale; about fifteen minutes later her face was flushed and moist, body warm, hands, knees, and feet cold. This soon passed off, leaving her in her former condition. Temperature was 95.4°, lower than at 8 o'clock. This afternoon asked for a sour drink and a big cake. Spoke hurriedly, but quite loudly and distinctly. Kissed the nurse twice when asked to do so.

February 9.—Has not been well at all to-day. Moaned when disturbed. Has eaten scarcely anything, but has taken more milk than usual. Has had slight diarrhea since last Tuesday; worse to-day.

February 11.—Asked frequently for drinks to-day, and last night said her throat was burning. Does not appear to recognize any of her friends nor to realize that she is among strangers. So long as her wants are attended to she seems quite unconscious of anything else; not exactly unconscious either; but as though she took no interest in what went on around her.

February 12.—Is better this morning; had no diarrhea during the night. Has asked three times for something to eat, which sounds like meat, but when I get it for her she will not eat it.

February 13.—Diarrhea much worse to-day.

February 15.—Diarrhea somewhat better.

On the 16th she was slightly better, and asked for beer and cocoa, and said she felt as if she were burning up. From this time she steadily grew worse, and died on the 26th.

Dr. Ruttan, professor of chemistry, McGill University, made elaborate analyses of urine sent to Montreal from time to time, and without offering any detailed statement here, I may say that the general conclusions arrived at were as follows: The whole of the urine passed in six days was sent, and he says the total amount, if representing six days' urine, is about one-seventh the normal. This contains all constituents in about normal quantities in relation to the volume of the urine, except the phosphoric acid, which is about one-third what it should be.

AUTOPSY.

Inspectio cadaveri.—Nutrition poor; body much emaciated; apparent age 65 to 70; weight about 50; rigor mortis complete. Ante mortem staining on hands and feet; post mortem staining on back of trunk; bedsores on sacrum, tip, and ball of great toe; feet and ankles edematous; legs flexed on thighs by contracted tendons; no teeth, and jaws much absorbed.

Sectio cadaveri.—Head: Scalp thin and easily dissected; calvarium of average thickness; tables thin, however, diploë being in excess; dura mater not adherent to the skull, slightly opaque at vertex; one slight adhesion to brain at margin of longitudinal fissure; ante-mortem clots in longitudinal and lateral sinuses, the clots in the lateral sinuses being particularly well organized.

Brain: The brain weighed about 35 ounces; macroscopically, it was healthy in appearance; in fact in asylum experience I have never seen as healthy a brain in the post-mortem room. Convolutions well marked and sulci deep; gray matter abundant; brain substance firm; ventricles free from evidence of disease; brain not examined microscopically.

Thorax: Substernal adhesions. Emphysema of cellular tissue beneath sternum; cartilages not ossified.

Heart: Small; weight, 3¾ ounces. Pericardial fluid in average quantity; blood in great veins, and right auricle fluid; walls of right auricle and ventricle unusually thin; valves normal; small postmortem clot in left ventricle; walls of left ventricle hypertrophied; left auricle normal; valves of left side normal.

Aorta: Ascending aorta dilated into a fusiform aneurism; capacity about twice that of normal; arterial coats not thinner than normal; no evidence of atheroma; no pressure effects noticed; varicose veins on posterior walls of the heart; abdominal aorta atheromatous; antemortem clots in abundance.

Lungs: Right, very adherent at apex; small adhesions all over surface of lung; apex, a mass of tubercle; in fact, tubercles were found scattered throughout the whole lungs, and in the apex a small cavity existed; hypostatic congestion marked. Left, in this lung a certain amount of hypostatic congestion was apparent, and an occasional tubercle was found; otherwise the lung was normal; cord-like adhesions of pleura on surface.

Abdomen: Liver adherent to chest walls and diaphragm; whole capsule tore off in taking out and remained attached to diaphragm and abdominal wall; weight, 20

ounces; three vertical furrows present on anterior surface of right lobe; these furrows were about 2 inches in length; center one distinctly marked; nutmeg condition present.

Stomach: Large; about 2 inches from pyloric orifice was a constricted portion. This condition was undoubtedly not the result of any inflammatory action, but the natural shape of the stomach, giving rise to an appearance suggestive of a rudimentary second stomach.

Intestines: Small; evidences of an old peritonitis; adhesions everywhere; there were several constricted portions from 3 to 6 inches long; in no place was there complete stricture, and no scars were present; above the constricted portions the intestine was much distended.

Cæcum: Walls much thickened and much venous congestion; inner surface dark red, and roughened; had appearance of numerous varicose veins in wall.

Ascending colon: One portion constricted, and part preceding dilated; transverse colon, normal; descending, slightly dilated.

Kidneys: Right, very small, about 2½ inches long; apparently normal; left, about an inch longer than right; apparently normal; capsules non-adherent.

We may sum up the case by saying that in the subject under consideration we have a woman inheriting from parents an intensely neurotic organization, in consequence of which she showed many indications of an ill-balanced and unstable nature culminating in various vital crises, including periods of stupor. In fact, this woman seems to have spent nearly one-third of her whole existence in an unconscious condition, being then a purely vegetative organism. At one period of her life she was a veritable Rip Van Winkle, finally sinking into a long lethargy from which there was only a brief consciousness prior to the final stoppage of the vital mechanism. But it is to be noted this curious condition was not the result of any gross lesion of the brain, but of hidden molecular peculiarities, which renders the case to my mind all the more instructive when considered in connection with all those states I am now considering.

II.

I propose now to discuss the real nature of hibernation and kindred states.

In the paper on squirrels, read before the Royal Society of Canada in 1887, I said, speaking of hibernation:

> I think it is very probable that, when the matter has been fully investigated, all degrees of cessation of functional activity will be found represented, from the fully normal sleep of man and other animals, to the lowest degree of activity consistent with the actual maintenance of life.

As a matter of fact this is the conclusion toward which all my investigations since that time have tended. Though some maintain that in true hibernation there is cessation of respiration, it would be hard to prove this; for, as Hall showed, the circulation continues and the very beating of the heart against the lungs displaces a certain amount of air, and in any event we can not leave out of account diffusion of gases which in all cases of animals with lungs plays an essential part in the process of respiration. It would be interesting to know the condition of the heart in a hibernating frog or turtle, but in such creatures the skin, as also probably in snakes, has a respiratory function. Live frogs will stay for hours at the bottom of a tank in winter provided fresh water is flowing over them constantly. In fact, winter frogs kept under these conditions respire largely by the skin. So far as the bat is concerned it is difficult to observe any respiratory movements, but in the woodchuck I never fail to notice them at considerable intervals, say once in five to nine minutes, even when hibernating most profoundly. The respirations were peculiar. Sometimes one deep inspiration, preceded by a sudden relaxation of the enlarged chest, would be succeeded by a long pause; again, there would be a series of very slight respiratory movements. It was always possible by the respirations alone to predict when the animal was approaching the waking state. The awakening was never sudden, but gradual, often extending over hours. I have seen something like this, though less remarkable, in the bat. This is no doubt protective to the vital machinery, for when Hall maintained that bats suddenly awaked from the hibernating condition died speedily, he was in the main, if not entirely, correct.

A brief consideration of natural daily sleep will throw light on winter sleep. Sleep is favored by moderate exhaustion, a good condition of nutrition, and the

absence of all sorts of peripheral stimuli. The case of the youth having but one good eye and one hearing ear who could be put to sleep by closing these up is very instructive. This lad did not, however, continue to sleep indefinitely, but awoke after a number of hours, showing that though there are certain conditions in the environment that favor sleep, the latter is essentially a condition of the central nervous system and dependent on laws governing the latter. This view makes it clear that sleep is naturally a nocturnal condition for most animals, owing, no doubt, to the evolution of life in relation always to the environment. The fact is we can not conceive of life except in and by reason of, in a sense, some environment. The change of the seasons, day and night, and all the periodicities of the inorganic world have as a natural consequence stamped themselves on living things, plants as well as animals. Sleep, then, is essentially a rhythmic diminution of the activities of all the tissues, but especially of that one, which controls all others, the nervous. Rhythm seems to be at the basis of all things organic and inorganic, but has not been enough considered in our explanation of living cells. It was long the custom to explain sleep by anæmia of the brain, whereas the very anæmia was due to a contraction of the blood vessels of the part accompanied by the diminution of the heart beat, both of which are periodical and dependent on the rhythm of the nervous system itself. Of course, temporary anæmia of the brain favors sleep, though it is not the essential cause. As a natural consequence of the decline in the activity of the great controller of the cell activities (metabolism), i. e., the nervous centers, it is found that all the functions of the body, without exception, perhaps, are diminished during sleep. Marshall Hall and others since his time have shown that the gaseous interchange in a hibernating animal is greatly lessened. This diminished metabolism explains why the animal does not require to eat, or but little. It explains the diminished excretions, etc., etc. This being understood, it is not surprising that hibernating animals may be kept under water for long periods, as is the case with newly born mammals, as kittens and puppies, whose vital machinery as yet works very slowly, which are in fact in a condition but slightly more advanced physiologically than the uterine, which is a sort of a reptilian prenatal state, as regards the circulation and respiration.

As the metabolism of reptiles and amphibians is of a much slower kind than that of mammals it is not surprising that their winter sleep is more profound. But it is to be observed that the change from their most active to their most sluggish condition is not probably relatively greater than in the case of mammals. All forms of profound winter (or summer) sleep are protective, both of the individual and the species. Manifestly amphibia, reptilia, and other groups of the animal kingdom must have utterly vanished from the face of the earth but for such a power to adapt to conditions. Probably many individuals, if not some entire groups, have, through more or less complete failure to adapt, disappeared before this habit of the nervous system and of the whole organism became perfect enough. It is equally clear, from the investigation given to the subject, that hibernation, like daily sleep, is not a fixed and rigid thing, but just as it has been the result of adaptation to the environment by virtue of the plasticity of function of all living cells, so the power to modify still remains. It is possible to conceive of its being lost in certain groups of animals; indeed, this phase of the subject has been as much impressed on me as the other. Sleep, hibernation, and all such states are not invariable, but to a certain extent so dependent on the surroundings that, as in the case of my last marmot, also of turtles and frogs kept within doors, there may be an omission of that condition which is habitual under the normal environment of the animal.

I would like to emphasize these facts, for they seem to me to throw great light on the evolution of function at all events, and on those changes which may become so great as to lead, we can hardly say, to what, in the lapse of time. For years I have had turtles, and especially frogs, under observation during the winter months. Our frogs for laboratory use at McGill University are kept in a tank in which the water

is being continually renewed by a slow stream. They are not fed. None of the frogs seem to pass into a condition of true hibernation, but they descend to the bottom of the tank and remain quiet, as if asleep or partially torpid, as indeed I know they often are for hours. In this is an interesting modification of that most profound torpor which they experience when buried in the mud of ponds. Even in the winter life of a creature like the marmot we may have all degrees of drowsiness or torpor, as I have shown; and it is not to be forgotten that our own daily sleep has its degrees, so that the night's sleep may be represented by a curve with a sharp rise and very gradual fall, which may, as we all know, be greatly modified by circumstances. The same laws seem to apply to all the known cases of human lethargy, hibernation, sleep, or whatever the state may be called. In the case of the buried sheep and hogs the protective value of the condition is evident, as also in the case of the lethargic woman. This individual, with so ill-balanced and unstable a constitution, would probably have been carried off by some form of actual disease long before had she remained awake. She could exist as a mere vegetative organism, but not as a normal human being in the ordinary struggle for existence. One thing which has been much impressed upon me by my studies of this whole subject is the varying degrees of sensitiveness to temperature and meteorological conditions in different groups of animals and different individuals of the same group. The bat as compared with the marmot, for example, may be worked like a machine by varying the temperature. On the contrary, the degree to which the woodchuck is independent of temperature was a surprise to me after my experience with the bat. But the woodchuck answered like a barometer to predict storms; in fact, I am satisfied that many wild animals have a delicate perception of meteorological conditions which man has not, and which in a sense makes them wiser than our science and wiser than they know, for they act reflexly, as it were. Often my marmot would be heard in the night scraping the straw about him prior to a storm that did not reach us for many hours after.

Marshall Hall laid it down as one of the principal conclusions that in hibernating animals "muscular irritability" is increased. If the term reflex be substituted for muscular I believe the conclusion is correct. I found as a result of scores of trials that when the marmot was hibernating he was more sensitive to slight stimuli, such as blowing on the hairs of the skin, than when merely sleeping. Plainly this was not a case of muscular irritability at all, but it does indicate that the reflex mechanism is more excitable as it is, for example, in an animal under the influence of strychnine and as it is in animals from which a portion of the cerebrum has been removed. It may be because the unconsciousness is so profound, i. e., the brain so far from its ordinary functional activity, for it is well established that the brain inhibits the spinal cord normally to a certain extent. Apparently this increased reflex excitability must be to the advantage of a hibernating animal, for the cord and medulla oblongata are the parts of the nervous centers that especially preside over the functions of organic life which are necessary to maintain a mere animal existence. All problems of a biological kind must ultimately be referred to cells, and so with this of hibernation. Indeed, it would seem that unicellular animals pass into a condition which is related to that of hibernation. The so-called encysted stage of protozoa is perhaps analagous and similarly preservative of the individual and the species.

The study of a subject like the present one gives rise to many questions. Can the molecular machinery of life entirely stop and yet be set in motion again? We know that cold-blooded animals may be frozen and completely restored to a natural condition. This and the encysted condition of protozoa are suggestive of such a possibility. Yet in insects a condition of perfect quiescence is accompanied by the most wonderful changes. The wormlike caterpillar becomes within its cocoon the butterfly with locomotive powers immeasurably greater. For myself the more I study biological problems the less am I inclined to subscribe to rigid formulæ of

being. The study of a single group of animals from a physiological point of view, much less that of a single individual, does not suffice to enable one to lay down laws that will apply to similar processes in other groups of animals except in the most cautious way. I can never forget the lesson of my marmot that did not hibernate at all, and what modification of present views more extended study of this subject of sleep in all its phases will produce, it is impossible to say.

All my own studies have greatly impressed me with the plasticity of living things, their power to adapt themselves to altered environments; and if I might suggest one of the great changes that is likely to come over the biology of the future, it is a recognition of the above fact; so that we will cease to generalize so widely from such narrow data, or rather, perhaps, we will be ready to believe that phenomena very different from those we know may be possible in the realm of living things. It has often occurred to me that possibly if such considerations were kept in mind we should not be disposed to assume that the conditions under which life now exists are precisely those under which it always did exist. Would not a little more biological agnosticism help such sciences as geology and paleontology?

PATHOLOGICAL ANATOMY OF YELLOW FEVER.

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I shall now direct your attention to a subject of great importance to all students of medicine and of transcendent importance to the practitioners of medicine in tropical, semi-tropical, temperate, and insular America,—the pathological anatomy of yellow fever.

If you will examine carefully the systematic treatises in the theory and practice of medicine, you will find but little of value relating to the pathology of yellow fever; in fact, you will find the statement in some of your text books that "yellow fever has no pathology." I shall deal solely with the results of my clinical studies, post-mortem examinations, and micro-chemical investigations of the past thirty years, and I feel assured that you will agree with me that yellow fever has a distinct pathological anatomy, wholly different from that of malarial fever, and as distinctively characteristic as the pathology of typhoid or enteric fever.

It is of the utmost importance that the Southern physician, as well as the practitioners in all the maritime cities, should be able to diagnose accurately the various forms of fever. The report of a case of yellow fever in any city within the bounds of the United States excites wide speculation. The people flee from the infected spots and rigid quarantines are rapidly instituted against the suspected locality. If an error is made in diagnosis, if it be not yellow fever, great damage results to the commerce and to the happiness of the suspected people. If, on the contrary, the disease be allowed to spread, through the failure of the medical profession and of the health authorities to correctly and promptly determine its existence, the epidemic may gain such headway that it can never be arrested and thousands of lives may thus be sacrificed. In the United States yellow fever is limited to certain months of the year and never prevails during the winter months. Even here in New Orleans the epidemics have been bounded by sharp lines. In Cuba, Havana especially, and in Mexico, Vera Cruz especially, the disease may prevail through the entire year.

I call your attention to the following table, which I have constructed for the purpose of illustrating the relations of yellow fever to climate in this city.

*Monthly deaths by yellow fever during a period of thirty-two years, 1847–1878.**

Year.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Date of first case.
1847	.....	.....	74	965	1,100	198	33	.....	2,306	July 6.
1848	.....	4	33	200	467	226	20	.....	808	June 21.
1849	.....	.....	1	17	314	416	112	9	769	July 28.
1850	1	.....	4	62	33	4	.....	.....	107	1 death January; 2 March; 1 May.
1851	.....	.....	.....	8	6	2	1	.....	17	
1852	.....	.....	2	8	91	198	105	11	456	July.
1853	2	31	1,521	5,133	982	147	28	4	7,849	May 22.
1854	.....	2	29	532	1,234	490	131	7	2,425	First death June 12.
1855	.....	5	382	1,286	874	97	19	7	2,670	June 19.
1856	.....	.....	.....	14	40	16	4	7	74	June 28.
10 years	3	42	2,046	8,225	5,041	1,794	453	55	17,481	
1857	.....	1	1	1	8	98	82	8	200	1 death reported in January.
1858	.....	2	132	1,140	2,204	1,137	224	5	4,845	1 death reported January 19.
1859	.....	.....	.....	.....	1	59	28	3	91	June.
1860	.....	.....	3	7	5	.....	.....	.....	15	
1861	.....	.....	.....	.....	.....	.....	.....	.....	.....	
1862	.....	.....	1	.....	1	.....	.....	.....	2	
1863	.....	.....	.....	.....	2	.....	.....	.....	2	About 100 cases in United States river fleet.
1864	.....	.....	.....	.....	.....	4	1	1	6	About 200 cases and 57 deaths, United States gunboats and river fleet.
1865	.....	.....	.....	1	.....	.....	.....	.....	1	
1866	.....	.....	.....	5	56	89	31	4	192	One death August 10.
10 years	.....	3	137	1,154	2,277	1,387	366	21	5,354	
1867	.....	3	11	255	1,637	1,072	103	26	3,107	One case died June 10.
1868	.....	.....	.....	.....	.....	5	.....	.....	5	October 5, died in Charity Hospital.
1869	.....	.....	1	.....	.....	2	.....	.....	3	July 17.
1870	.....	1	.....	3	231	242	106	5	588	May 26.
1871	.....	.....	.....	2	9	22	19	2	54	July 30.
1872	.....	.....	.....	1	5	24	7	2	39	August 28.
1873	.....	.....	3	19	208	79	17	.....	226	July 9.
1074	.....	.....	.....	.....	2	6	2	2	11	August 19.
1875	.....	.....	.....	5	24	20	9	3	61	August 8.
1876	.....	.....	.....	1	19	17	4	1	42	August 11.
10 years	.....	4	15	286	2,135	1,489	267	40	4,136	
1877	.....	.....	.....	.....	.....	.....	1	.....	1	November.
1878	2	.....	50	974	1,893	1,044	90	3	4,056	May 25.
2 years	2	.....	50	974	1,893	1,044	91	3	4,057	
32 years	5	49	2,248	10,639	11,346	5,714	1,177	119	31,028	
1879	.....	.....	.....	.....	.....	.....	.....	.....	19	
1880	.....	.....	1	.....	.....	1	.....	.....	2	
1881	.....	.....	.....	.....	.....	.....	.....	.....	.....	
1882	.....	1	1	2	.....	.....	.....	.....	4	
1883	.....	.....	.....	.....	.....	.....	1	.....	1	
Total	5	50	2,250	10,641	11,346	5,715	1,178	119	31,054	

* Reports of Joseph Jones, M. D., President of the Board of Health, State of Louisiana, 1880, 1881, 1882, 1883.

From the preceding table it is evident that, as a general rule, the great epidemics, as those of 1847, 1819, 1853, 1851, 1855, 1858, 1867, and 1878, commenced early in the hot months (May, June, and July), and attained their maximum intensity in August and September. Thus, during the period of thirty-two years the deaths from yellow fever in New Orleans were as follows: January, 6; February, 0; March, 2; April, 0; May, 5; June, 49; July, 2,248; August, 10,639; September, 11,346; October, 5,714; November, 1,177; December, 119. The curve of yellow fever, therefore, corresponds, to a certain extent, with the curve of temperature. Thus, from the records of thirty-eight years, which I have consolidated and calculated from the most reliable data, the mean temperature of New Orleans is as follows: January, 56.28°; February, 58.03°;

March, 64.27°; April, 69.41°; May, 75.90°; June, 81.35°; July, 83.21°; August, 83.11°; September, 79.64°; October, 70.27°; November, 62.80°; December, 56.43°. Averages: spring, 69.56°; summer, 82.53°; autumn, 70.75°; winter, 56.91°; year, 69.51°. The origin and spread of yellow fever, therefore, depends absolutely upon an elevated temperature, ranging from 70° to 85° F., and its decline depends upon a mean temperature ranging from 65° to 56° F. These figures, of course, relate to the mean or average monthly temperature, the extremes being much higher or lower, ranging during the year in New Orleans, as shown by meteorological observations extending from 1817 to 1878, from 17° F. to 100° F. Seaports liable to the infection of yellow fever should be carefully inspected and in the event of the appearence of the disease, the case or cases should be at once isolated and the surrounding houses, yards, and streets thoroughly cleaned and disinfected. Fight the enemy immediately on sight, vigorously, continuously, and with the best-known agents and appliances.

PATHOLOGICAL ANATOMY OF YELLOW FEVER.

Exterior.—Generally full and much reduced in flesh; features may even present a swollen and bloated aspect; skin of face and upper portions of trunk of a golden yellow color. The dependent portions of the body are of a mottled purplish and yellow ecchymotic appearance. Black vomit frequently oözes from the corners of the mouth and trickles down the face and neck. When the muscles are cut a large quantity of dark blood escapes, which, upon exposure to the atmosphere, changes to a bright scarlet hue. Putrefactive changes take place rapidly after death. In some cases of yellow fever, especially when the functions of the kidneys have been arrested for some time before death, the putrefactive changes take place with great rapidity and energy, and sometimes even appear to commence before death, the body exhaling a disagreeable odor.

Cerebro-spinal nervous system; sympathetic nervous system.—The post-mortem examinations of the brain, spinal cord, and sympathetic system have thus far yielded no characteristic lesions to which the aberrant nervous symptoms of yellow fever can be referred. Beyond congestion of the capillaries of the cerebro-spinal and sympathetic systems, which congestion appears to be referable to the same cause as that producing capillary congestion in the internal organs, I have observed no structural or hæmorrhagic lesions, as fibrinous effusion or softening of the cerebro-spinal and sympathetic nervous structures. Chemical analysis revealed the presence of urea, bile, and leucin in the brain, and the effects of these substances, as well as to the direct action of the yellow-fever poison, must be referred the aberration of intellect, the restlessness, convulsions, and coma.

The amount of congestion of the blood vessels of the brain will, to a certain extent, vary with this stage, and with the conditions under which the death takes place. Thus, when the functions of the kidneys are greatly impaired or wholly suppressed, owing to the retention of the watery elements of the blood, the vessels throughout the entire system are filled with blood to repletion, and the brain is, especially from its soft structure and the character of its circulation, the most affected. In such cases the blood is seen issuing from the cut surfaces of numberless vessels when sections of the brain are made. Under the microscope the three sections of the brain reveal a state of great hyperæmia, the minute capillaries being filled with colored blood corpuscles. The golden hue of the brain substance and membranes, as well as most of the tissues generally, is due to the presence of the coloring matter of the bile, and also to the escape of hæmatin from the blood vessels.

When death occurs after profuse hæmorrhages from the stomach and bowels the cerebral structures present less evidences of congestion than when these symptoms have been absent or present to a smaller degree. It is probable that the cerebral ganglia and commissures, as well as those of the spinal cord and sympathetic nervous system, are affected with the same chain of chemical reactions, which result in the formation and accumulation in the blood of oil, and also of this product in the

heart, liver, and kidneys. Fatty degeneration has been observed in the nuclei of the minute vessels of the pia mater venules, as well as arterioles. In many vessels the nuclei had disappeared, leaving fat globules in their places. With reference to the brain the most prominent observation thus far made is the existence of fatty degeneration of the blood vessels of the cortex cerebri, similar to that observed in the vessels of the pia mater, together with degeneration of the ganglionic bodies of the cortex. If these observations should be confirmed by further research, and especially by chemical analysis, determining the exact proportion of the oil in the brain in health and various diseased states, it will thus be shown that the nervous system, both cerebro-spinal and sympathetic, is involved in a similar series of changes as the other organs. The universality of these changes point to the blood as the great medium and source of the chemical actions and we have a confirmation of this view in the fact, which I have determined by chemical analysis, that the oleaginous constituents are greatly increased in the blood of yellow fever. That the mere presence of oil in increased amounts in certain organs during yellow fever is not the cause of the gravest symptoms is evident from the rapidity of the convalescence in many cases and also from the well-known fact that in many cases the general health is greatly improved by an attack of yellow fever. The gravest symptoms of this disease must be sought not merely in the structural alterations of certain organs, but in the initial chemical changes induced by the poison, and which precede the final lesions discernable after death.

Heart: Pale yellow and brownish yellow, as if undergoing fatty degeneration. Structures of the heart flabby and somewhat softened; numerous oil globules deposited within and around the muscular fibrillæ of the heart. The appearance of the heart in a case of yellow fever (Edward Griffin, who died in the Charity Hospital of yellow fever November 9, 1876, on the sixth day of the disease, after the ejection of large quantities of black vomit) is represented in the following colored figure (No. 1). Heart yellow and softened. Under the microscope transverse markings of muscular fibres indistinct, and much oil and granular matter deposited within and around the muscular fibres. The appearance of the muscular fibres of this heart are represented in Fig. 2. One thousand parts of the muscular structure of the heart contained water, 786.44; solid matter, muscular fibre, etc., exclusive of oil, 267.06; oil, 46.50. In this case the left ventricle was dilated and hypertrophied, but this condition appeared not to have affected the health of the patient before the advent of fever.

In the case of Samuel Rinsley, aged 23, who entered the Charity Hospital November 14, 1873, in the fourth day of an attack of yellow fever and who threw up black vomit on the 16th and 17th and who died at 1 o'clock P. M. on eighth day of disease, the autopsy was made eight hours after death. Weight of heart, 9 troy ounces; great congestion of blood vessels of pericardium, resembling the appearance of the pericardium of a case of yellow fever which died on the sixth day of the disease, August 5, 1871, represented in Fig. 3. The blood vessels of the heart were distended with dark-colored blood; the cavities of the heart contained about 3 fluid ounces of blood and golden-yellow clots; vena cavæ and pulmonary veins filled with fluid blood. When washed the muscular structures of the heart presented a distinct yellow color, similar to that of the heart delineated in Fig. 1, and was readily mashed between the fingers. Under the microscope the muscular fibrillæ presented indistinct transverse striæ and contained numerous oil globules and much yellow granular matter, resembling the fibres of the heart of a case of yellow fever depicted in Fig. 2. One thousand parts of the muscular structures of the heart contained water, 736.65; solid matter, exclusive of oleaginous matters, 186.80; oil, 76.59.

In the preceding case oil or fat was present in abnormal quantities in the muscular structures of the heart, the fat being deposited within and around the muscular fibrillæ in the form of minute globules of various sizes. There is also an obliteration or obliterations of the muscular fibrillæ of the heart, leading to a disappearance of the muscular striæ.

Fig. 1: Appearance of Heart of E. Griffin, died of Yellow Fever.

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th sulphuric
her Yellow Fever
inch objective.

Fig. 2: Fibres of Heart of E. Griffin died of Yellow Fever ⅛ inch objective Beeks.

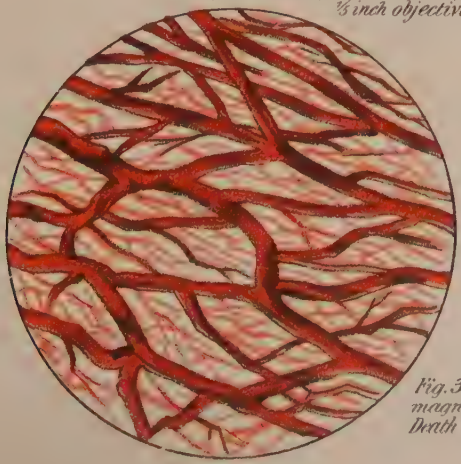

Fig. 3: Pericardium magnified 2 inch objective Death 6th day of disease.

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The removal of the particles of oil from the muscular structures of the heart by sulphuric ether did not restore the obliterated striæ, neither did this agent remove all the molecular particles, a portion at least being insoluble in ether, alcohol, and chloroform, and having an analogous constitution to albumin and fibrin. It would without doubt be a matter of great interest to medical science to establish clearly the exact physical and chemical changes which result in the final transformation of the muscular structures of the heart and secretory and excretory structures of the liver and kidneys into fat. The difficulties of such an investigation are very great, especially as the chemical research can be commenced only in fatal cases and after death. The complete investigation of this subject should embrace the following inquiries: (1) Is there an actual increase of the entire amount of fat in the blood organs and textures in yellow fever? (2) Is there any movement of the fatty matters from the positions in which they are chiefly accumulated in health, as in the adipose tissue, the marrow of the bones, the brain, spinal cord, and nerves generally, during the febrile stage of yellow fever? (3) Are the heart, liver, and kidneys simply infiltrated with fat conveyed by the blood during fever? (4) Is there an actual conversion of the fibrin and albumin of the blood and the albuminous elements of the heart? (5) Does the accumulation of fat in certain organs in this disease result from chemical changes directly excited by a specific poison, or from imperfect oxidation, or perverted nutrition? (6) Has the perversion and arrest of the functions of the liver and the retention in the blood of the constituents of the bile any relationship to the deposits of fat or oil in the various organs?

As the acute fatty degeneration of yellow fever is in nowise dependent upon the food of the patient during the fever, the change occurring with rapidity during absolute starvation, it is evident that the only possible sources of the oil or fat are those indicated in the preceding inquiries, namely, the preëxisting sources of fat in the transformation of the heterogeneous and albuminous constituents of the blood and organs. The cavities of the heart in many cases are filled with dark fluid blood, yellow fibrous clots sometimes present. The yellow-fever blood contains abnormal amounts of urea and extractive matters and ammonia.

By testing blood greatly diminished in amounts I have determined both by chemical analysis and microscopical examination that the heart undergoes fatty degeneration in yellow fever. As far as my observations have extended, the heart undergoes more rapid and extensive degeneration in yellow fever than in an any other acute disease. The acute fatty degeneration of the heart in yellow fever should not be confounded with similar changes observed in spirit drinkers and in certain cases of chronic disease, but is more probably dependent upon the same or some chemical actions as those leading to a similar result in phosphorus poisoning and in typhoid and typhus fevers. In yellow fever the fat is deposited within and around the muscular fibrillæ of the heart in the form of minute globules of various sizes. There is also an alteration or degeneration of the muscular fibrillæ of the heart, leading to a disappearance of the striation. The removal of the particles of oil from the muscular structures of the heart by sulphuric ether does not restore the obdurated striæ, neither does this agent remove all the molecular particles, a portion at least being insoluble in ether, chloroform, and alcohol and having an analogous constitution to albumin and fibrin. Fatty degeneration of the heart is, therefore, not the sole state of this organ in yellow fever. The molecular change has taken place in the substance of the muscular fibers and this change affects the albuminoid or nitrogenous constituents, and most probably represents one of the stages of acute fatty degeneration. The pericardium in yellow fever presents a congested appearance. Under the microscope the minute blood vessels appear to be congested with colored blood corpuscles. The pericardial fluid is of a deep yellow color. The appearance presented by the pericardium of a case of yellow fever which terminated fatally in New Orleans August 5, 1871, is represented in Fig. 3. The pericardium was put upon a glass slide and

preserved in Canada balsam. The drawing represents the natural appearance as injected with blood.

Lungs: Dependent portions greatly congested, otherwise normal. In some cases circumscribed effusions of blood in structures of lungs. I have in a few instances observed pneumonia as a supernumerary disease in yellow fever. In such cases the sputum consisted of almost pure blood. The supervention of pneumonia causes a continuation of the febrile phenomenon beyond the usual period of the uncomplicated disease.

Stomach: Mucous membrane of the stomach in many cases internally congested, softened, and eroded. Stomach often contains large quantities of black vomit. Reaction of black vomit often alkaline, from the presence of ammonia, resulting from the decomposition of urea, eliminated by the gastro-intestinal mucous membrane. Ammonia and urea present in the black vomit ejected during life, and also when examined almost immediately after death. The presence of ammonia in the stomach and black vomit was not the result of post-mortem putrefactive changes. In many cases ammonia was present in such large amounts that when a rod dipped in hydrochloric acid was held over the mucous membrane of the stomach or over the black vomit, dense fumes of chloride of ammonium were found, as if the rod had been held over a bottle containing liquid ammonia. Chemical analysis revealed the presence of ammonia, and also of urea in the black vomit. Under the microscope the black vomit is seen to contain colored blood corpuscles, and cells of the mucous membrane of the stomach, and broken capillaries. In some cases fungi and fibrin were numerous in the black vomit, in others they were absent.

That the stomach suffers and suffers severely in yellow fever is evident from the fact that in the great majority of cases the stomach is finely injected with blood and exhibits, even when examined immediately after death, abrasions of the mucous membrane in pit-like folds and furrows. In some cases the whole surface of the stomach is affected, and in others the effusion and injection is confined to the cardiac or pyloric portion, but in some rare instances the stomach, duodenum, and intestines have been said to present an almost entire absence of apprehendable lesions. I have not myself, in post-mortem examinations, observed the absence of lesions in the gastro-intestinal mucous membrane. The congestion of the stomach is to a certain extent due to the disturbance of the circulation in the line, but not wholly to this cause. We must, after careful chemical and microscopical examination, admit the existence of irritation, desquamation, and hæmorrhages.

The congested appearance of the mucous membrane of the stomach after death from yellow fever is represented in Figs. 4 and 5—Charity Hospital, October, 1871, and Charity Hospital, November, 1876. These illustrations must be regarded as exhibiting the extreme conditions of congestion in the mucous membrane of the stomach in yellow fever. In many cases the stomach after death presents less congestion, and in some portions of the mucous membrane different degrees of congestion are manifested, being much greater in some portions of the mucous membrane of the stomach than in others.

Intestines: As a general rule these viscera are dark colored and distended with gas. In some cases the reaction of the intestinal contents was strongly alkaline from the presence of ammonia. Hæmorrhage from the intestinal mucous membrane has been observed during life, and in such cases, as well as in others in which no blood has been discharged previous to death, the intestines have been found, in post-mortem examinations, distended with blood. A remarkable feature in yellow fever is the frequent occurrence of intussusception of the small intestine. The quantity of intestine invaginated sometimes exceed a quart. The large intestine and the lower portion of the small are not so often found congested as the stomach and duodenum, yet such a condition is by no means rare. Congestion of the veins, venules, and mucous membranes generally in yellow fever has been referred to the anatomical distribution of the veins, which like those of the stomach are tributaries to the portal veins,

Fig. 4: Mucus membrane of Stomach in Yellow Fever.

Fig. 5: Mucus membrane of Stomach in Yellow Fever.

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Yellow Fever.

Fig. 6: Appearance of Liver in Yellow Fever Charity Hospital October 1871.

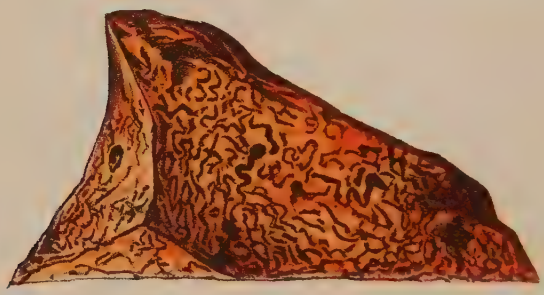

Fig. 7: Cirrhosis & Fatty degeneration of Liver Savannah Georgia 1856.

Fig. 8: Liver of Yellow Fever Succeeding Malarial Fever

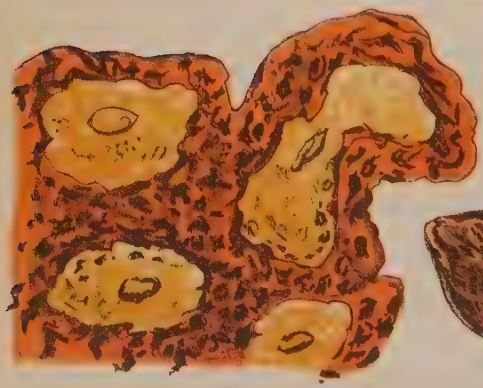

Fig. 9: Section of 30 Magnified.

Fig. 10: Liver of Yellow Fever following Malarial Fever.

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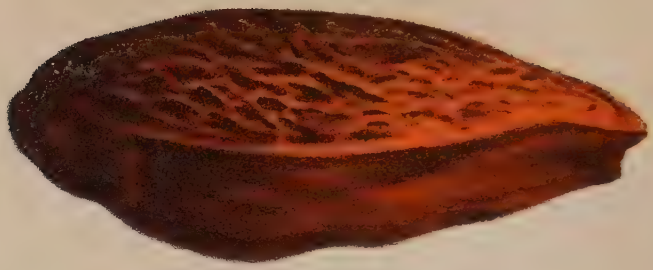

Fig. 11: Liver Malarial Fever, Acute Stage.

Fig. 12:
Liver Malarial Fever.

Fig. 13: Liver Malarial Fever
loaded with pigment granules.

Fig. 14.
Section of Liver Malarial Fever
showing pigment deposit
1 inch objective 1871

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but we have been inclined in many cases to regard the congestion as active and not passive. During life the rectum in yellow fever presents an intensely red and congested appearance, and some cases of yellow fever in 1878 were followed by irritation and fissure of the rectum.

The demonstration which we have given, illustrating the changes of the nervous structures and of the heart, blood, and alimentary canal, under the action of the yellow-fever poison clearly establishes the fact that yellow fever has a distinctive pathology. It is necessary that we should pursue this subject to the end, and indorse our proposition by an appeal to the results of microscopical and chemical investigations of the pathological lesions of other organs, as the liver and kidneys in yellow fever. An accurate comprehension of the pathological anatomy of the liver in yellow fever is especially important, as we are enabled to establish in the clearest manner the most marked differences between the pathological anatomy of yellow and malarial fevers.

Liver: Yellow in color and bloodless, resembling this organ in fatty degeneration, but firmer and denser in structure. Fig. 6 presents the general appearance of the yellow-fever liver. The specimen was taken from a subject in the Charity Hospital in 1871. Fig. 7 illustrates the appearance of the liver in a case of cirrhosis, induced by spirit drinking, which died in the Savannah Hospital in 1856; there was not only cirrhosis, but also fatty degeneration in this case. Fig. 8 represents the appearance of the liver in a case of yellow fever ingrafted on malarial fever. Fig. 9 represents a portion of a section of the liver figured in No. 7, magnified, showing congestion of portal capillaries with pigment deposits, and the yellow, fatty, and degenerated central portions of the lobules of the liver. Fig. 10 presents the appearance of the liver in yellow fever ingrafted on malarial fever. The black, pigmentary matter alters the yellow color characteristic of the yellow-fever liver.

The preceding figures, representing the appearances of the liver in yellow fever, should be compared with the following figures representing the appearance of the liver in malarial fever. Fig. 11, appearance of the liver in the acute stage of malarial fever, bilious remittent. Fig. 12, appearance of the liver in malarial fever of longer standing. Fig. 13, appearance of malarial liver loaded with pigment particles. Fig. 14, section of malarial liver, showing pigment deposit, magnified by 1 inch objective, 1871. In all the different forms of malarial fever—intermittent, remittent, and congestive—which have continued longer than five days, and in which there have been no previous alterations of the structures, as in cirrhosis and fatty degeneration, I have found the exterior of a slate and the interior of a bronze color, as shown in figs. 11, 12, 13, and 14. Fig. — represents a magnified portion of the section of a malarial-fever liver, showing a deposit of pigment chiefly in the portal capillaries in the periphery of each lobule.

Under the microscope the textures of the yellow-fever liver are infiltrated with much oil. The secretory cells of the liver are thus shown by microscopical examination to contain much oil. The liver of uncomplicated yellow fever, as far as my observations extend, and according to the observations of Louis and many others, is of a bright yellow color. It is probable that this color, as in the case of the malarial liver, varies with the length of the attack and the effects of previous diseases. Thus, Dr. Samuel Jackson, of Philadelphia, found the livers of those who had died in the early stages engorged with blood. The ducts of the yellow-fever liver are of a golden yellow color, while those of the malarial liver are of a brownish-yellow color. The golden yellow color of the yellow-fever liver can be abstracted both by alcohol and water. The yellow-fever liver is firmer and harder than that of malarial fever, contains much less blood, and is much less readily acted on by liquor potassæ and mineral acids. Liquor potassæ readily dissolves the malarial-fever liver, the decoction presenting the appearance of venous blood, while no such effect is produced by this alkaline solution upon the yellow-fever liver.

Chemical analysis reveals the presence of urea and fat in abnormal amounts. Animal starch and grape sugar are also present in the yellow-fever liver. As a general rule, grape sugar is absent from the malarial liver. In some cases the deposit of oil is confined to certain portions of the lobule, and may even differ in amount in different portions of the liver; but in the majority of cases the fatty infiltration and fatty degeneration of the protoplasm of the hepatic cells extends throughout the whole organ. The oil is deposited both within and around the hepatic cells. Fig. 15 gives the appearance of the hepatic cells and oil globules in the liver of yellow fever (case of Griffin, November, 1876). This figure should be compared with Fig. 16, representing the appearance of hepatic cells and pigment particles in the liver of malarial fever. Careful observations of the relations of malaria to yellow fever, and an extended examination of the statement of various observers, have convinced me that the apparent contradictory statements made by various observers, as to the presence or absence of the yellow color of the liver, which Louis regarded truthfully as the characteristic lesion of the disease, has arisen from two sources, namely, errors of diagnosis and failure to detect the preceding concurrent and subsequent action of malaria on this organ. In uncomplicated yellow fever, fragmentary particles, so uniformly present in the malarial liver, are uniformly absent. When yellow fever is engrafted on malarial fever, the preceding changes brought by the paludal poison alter and mask those developed by the yellow fever. Hence, the mingling of the yellow color of acute fatty degeneration with the dark bronze and slate of the malarial liver may produce a color very closely resembling the Spanish brown of the healthy liver. Careful scrutiny and examinations of the organs under the microscope will reveal both the oil globules and pigment particles. The distinction has been made by pathologists between fatty degeneration and fatty infiltration, the first being a process of true degeneration, with a tendency to the disintegration of tissue; the latter we observe as a simple definition of fat, in various cells and tissue, without any chemical alteration of their constituent elements. In fatty degeneration there is a conversion of the protoplasm of the cells into fat, which accumulates in the cell body, and as the albuminoid principles disappear they are replaced, *pari passu*, by fatty particles. It is thus assumed that the nitrogenized albuminoid and proteid particles are converted into fat. The fat is usually present in the cell in very small particles or droplets, and these may coalesce and form larger drops. The protoplasm may even be almost entirely replaced by fat. In fatty infiltration cellular protoplasm is displaced; in fatty degeneration it is replaced; in the former the corpuscular organisms suffer mechanically; in the latter the cells suffer chemically, and are ultimately destroyed. Fatty infiltration of cells is a common occurrence in the normal as well as pathological condition; but in this case the fat appears to originate outside of the cells and simply accumulates in them, causing a passive atrophy of the protoplasm.

In general, the fat droplets are larger in fatty infiltration than in fatty degeneration, and yet to this there are many exceptions. In spite of the differences just considered, it is often practically impossible to separate one process from the other micro-chemical tests, and histological appearances are not always sufficiently reliable for exact differentiation. The efforts of some writers to discard the terms "fatty degeneration" and "fatty infiltration," and to substitute the words "fatty metamorphosis," simply expresses the theory that the two processes are one and the same. In the case of the liver, both, in health and in disease, we meet with great difficulties in separating the two processes. Fatty infiltration may occur as the efforts of the excessive ingestion of oleaginous food, in chronic alcoholic, phosphorus, and arsenic poisoning, in certain exhaustive diseases accompanied by malnutrition, and in pulmonary phthisis, chronic dysentery, and in various conditions which are not fully understood. Fatty degeneration of the liver in many cases can not be morphologically distinguished from fatty infiltration. The fat is believed to be

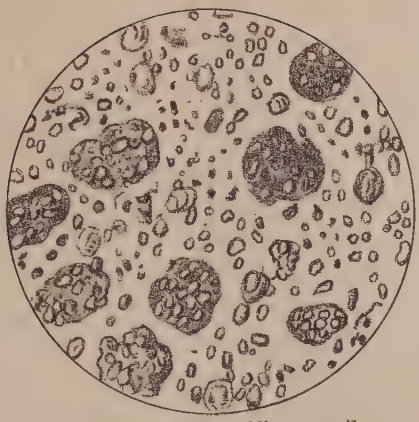

Fig. 15. Appearance of Hepatic cells in Yellow Fever. 1/5 inch 1876.

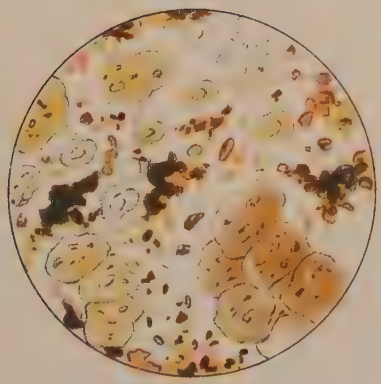

Fig. 16. Liver cells & pigment particles Liver of Malarial Fever, 120 diameters 1871.

From Nature by JOSEPH JONES, M.D.

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Illustrating the pathological anatomy of specific contagious yellow fever. Comparison between ordinary fatty degeneration of the liver, and fatty infiltration of the liver in yellow fever. Section of the gastric mucous membrane in yellow fever. Fig. 17 represents a magnified thin section of a fatty liver, in a moderate degree of advancement of fatty degeneration. The cells containing oil are seen to be distributed for the most part at the periphery of the lobules, in the vicinity of the branch of the portal veins. Fig. 19. Section of a yellow fever liver magnified 275 diameters, showing the presence of oil globules. The capillaries still contain blood corpuscles. The group of cells above the figure represent the hepatic cells undergoing fatty infiltration and degeneration. Fig. 18. Section of a yellow fever stomach, showing the congestion of the veins, the infiltration of hæmoglobin, and the extravasation of blood caused by a rupture of the minute veins or larger capillaries. The glandular (A) and muscular layer (B) of the mucous membrane, and the subcutaneous connective tissue (C) are shown. The congested vessels descending through the glandular layer represent those straight vessels formed by the various radicles arising from the network of large capillaries beneath the epithelium, and surrounding the orifices of the gastric glands. The dots seen throughout the muscular layer represent transverse sections of muscular fibrillæ (magnified 50 diameters), after H. D. Schmidt, M. D.

formed by a transformation of the protoplasm of the liver cells. The fat droplets are, for the most part, very small and abundant, though this is by no means constant. Fatty degeneration of the liver cells frequently follows, and is associated with cloudy swellings in the varying conditions in which they occur, or it may appear in profound anæmia, and in the exhausted condition of the human system consequent upon the prolonged action of the malarial poison.

The accumulation of fat in yellow fever appears to be due both to the degeneration of the protoplasm of the liver cells and to infiltration of fatty matter. My researches upon the fatty degenerations of the liver in yellow fever have led to the following conclusions: (1) The muscular tissues of the heart show under the microscope, and under the proper chemical tests, rapid molecular change and fatty degeneration; (2) the liver cells exhibit rapid degeneration of the protoplasm of these cells and rapid increase of fat; (3) the albuminoid elements of the blood undergo rapid degeneration and rapid transformation into fat, under the action of the yellow-fever poison; I use the term "rapid" in contradistinction to the slow process of the development of fat in the normal condition; (4) it follows from the preceding propositions that the accumulation of fat droplets in the heart and liver in yellow fever may arise from a chemical change of the albuminoid protoplasm of the blood and of the cells; (5) the increment of fat (oil droplets) in the blood in the heart and in the liver of yellow fever is due to the direct chemical action of the poison of yellow fever in the albuminoid protoplasm; (6) the fatty degeneration caused by the yellow-fever poison ceases with the cessation of the action, and elimination and destruction of the morbific agent.

The degeneration of the protoplasm excited by the yellow-fever poison is temporary and not permanent; (7) if the fatty degeneration caused by the yellow-fever poison were permanent, and if the changes thus induced by the yellow-fever poison were an abiding and progressive degeneration, we would witness the effects, and the continuous and destructive effects, of fatty degeneration of the heart tissue as the sequelæ to many cases of yellow fever. In our experience such effects are readily traceable to the yellow-fever poison.

Gall bladder: The gall bladder in yellow fever is, as a general rule, contracted, flaccid, small, and contains little or no bile. The amount of bile does not generally exceed 100 grains. In malarial fever, on the other hand, the gall bladder is, as a general rule, distended with dark greenish black bile. In yellow fever the vomiting is rarely bilious, unless in the commencement of the disease, and the black vomit contains little or no biliary matter. The small intestines are rarely, if ever, discolored by bile in yellow fever, while in malarial fever it is common to find the gastric mucous membrane discolored by bile. I have observed cases in which the gall bladder contained only a serous liquid coagulable by heat. In two cases a decided hæmorrhage had taken place into the gall bladder, which was distended with black blood. The bile in yellow fever contains numerous cells from the mucous membrane of the gall bladder and casts of the hepatic ducts.

Spleen: As a general rule this organ is but slightly enlarged; in many cases normal in size and appearance. In many cases of yellow fever the spleen is neither enlarged, softened, or altered in appearance either upon the exterior or within. There appears to be no special alteration or destruction of the colored corpuscles in the spleen of yellow fever as in that of malarial fever. The enlargement of the spleen in fevers does not, from these observations, depend upon the diminution of fibrin, because this element of the blood is diminished to a much greater extent in yellow fever than in malarial fever, and at the same time the spleen is enlarged to a greater and more marked degree in the latter. Another fact worthy of consideration in this connection is, that in yellow fever the blood corpuscles are not specially diminished in amount, while in malarial fever they are rapidly destroyed, and this destruction seems to be greater in the liver and in the spleen. In malarial fever both these organs are loaded with altered blood corpuscles and with the pigmentary granules

resulting from the alteration of the colored blood corpuscles, while neither the spleen nor the liver in yellow fever afford any evidence of the alteration of the colored blood corpuscles.

Suprarenal bodies: These bodies appear to be subject to similar changes with the liver and the heart, and oil is increased in amount in the cells of the cortical and medullary substances.

Kidneys: These organs in yellow fever as a general rule present a brownish-yellow color, much lighter than that of health. The kidneys, in common with the heart and liver, contain much free fat. Fig. 20 represents the appearance of the kidney in yellow fever, and Fig. 21 represents the appearance presented by a section of the same kidney. These figures may be regarded as representing the more decidedly morbid kidneys in this disease, for in some cases they present greater degrees of congestion and deeper coloration from the presence of blood in the capillaries.

In the case of Griffin, who died of yellow fever in the Charity Hospital November 17, 1876, sections of the kidneys, made with Valentine's knife, revealed under the microscope increase of oil globules and granular matter. Many of the tubuli uriniferi presented a thickened and altered appearance, as if undergoing the changes characteristic of cirrhosis. One thousand parts of the kidneys contained, water, 800.33; solid excretory, molecular, and fibrinous matter, 158.39; oil or fat, 40.88.

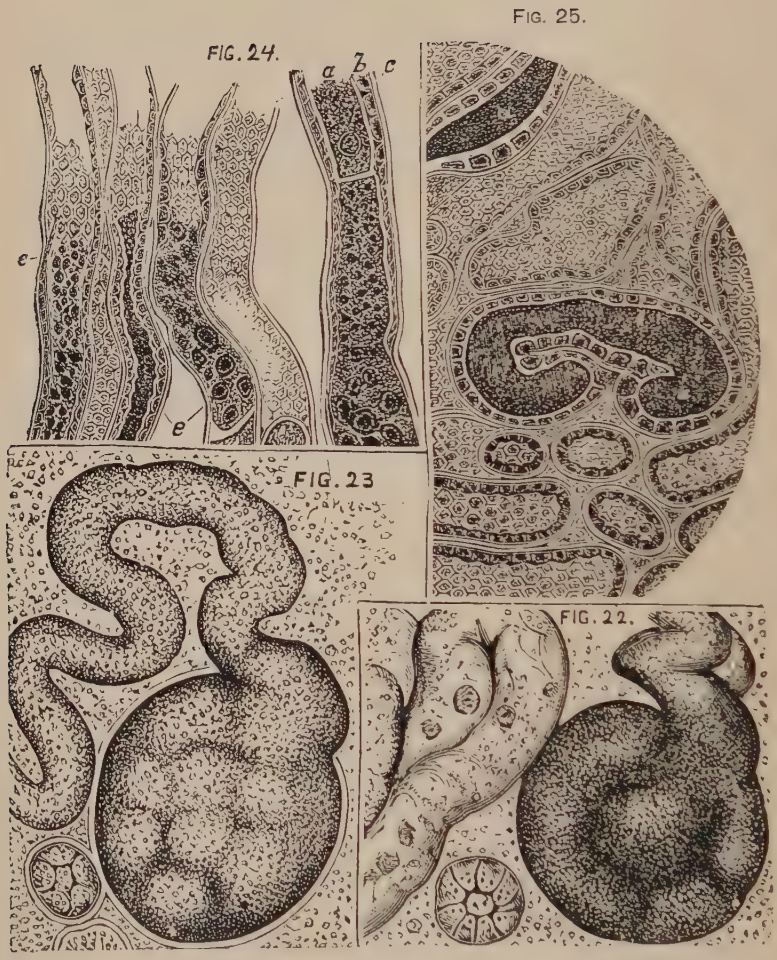
In the case of Samuel Kingsley, who died of yellow fever in the Charity Hospital, November 17, sections of the kidneys under the microscope presented the appearance usual in yellow fever, namely, Malpighian corpuscles, tubuli uriniferi filled with oil globules, yellow granular matter, and detached excretory cells. One thousand parts of these kidneys contained water, 798.90; golden-colored oil and fat, 57.77; cellular tissue, bloodless excretory structure, etc., 143.33. When these sections of the kidneys are examined under the microscope, the Malpighian corpuscles and tubuli uriniferi are found to be filled with granular albuminoid and fibroid matter, detached excretory cells, and oil globules.

As far as my observation extends, these structural alterations of the kidneys have escaped the notice of preceding observers. The importance of these changes in the kidneys can not be overestimated, for upon them apparently depends the suppression of the urinary excretion, which is an almost universally fatal symptom. The changes in the kidneys may depend on some causes, among which may be mentioned as of prime importance, the alterations induced in the albumin and fibrin of the blood by the febrile poison, and the congestion of the capillaries, caused by derangement of the vasomotor system of the nerves, and by the altered blood. This condition of the kidneys is preceded by capillary congestion, as has been shown by the results of post-mortem examinations at different periods of the disease. The same observation applies to the liver. The fatty degeneration and structural lesions are presented by hyperæmia; but neither in the kidneys nor in the other organs can the mere stagnation of the blood in the capillaries be regarded as the prime cause of the subsequent degeneration or disintegration of the textures, and more especially of the secretory cells. The chief cause is the action of the yellow-fever poison on the blood and textures. The yellow-fever poison excites a train of chemical changes, the final result of which is fatty degeneration. Thus, in the case of the muscular fibres of the heart, there is fatty degeneration, although from the structure and action of this organ there could be no such passive congestion as we have in the liver and kidneys. It is probable that the fatty degeneration extends to all the unstriped muscular fibres, and may even disable the muscles of locomotion and animal life. The granules of the cells of the epithelium of the uriniferous tubules, set free by the disintegration of the protoplasm, oil globules, detached cells, and albuminous matters and mucus, form opaque granular masses which block up the tubuli uriniferi. We have in these structural alterations of the kidney, which vary in kind and degree according to the stage of the disease, an explanation of the fre-

Fig 20: Kidney, Yellow Fever
reduced ¼.

Fig. 21: Section of Kidney
Yellow Fever; reduced ¼

Sackett & Wilhelms Lith. Co.



PATHOLOGICAL ANATOMY OF THE KIDNEY IN BRIGHT'S DISEASE AND YELLOW FEVER.

quent occurence of albumin, casts, detached cells of the epithelium of the uriniferous tubules, and oil globules and granular matter in the urine of yellow fever.

Fig. 22. Inflammatory division of Bright's disease. Bright's disease, first stage. Section of inflamed kidney, Bright's disease. Tubules with epithelium in situ with cloudy swelling, well shown in transverse section, Malpighian body large and opaque, magnified 450 diameters. The inflammatory form of Bright's disease may be divided into three stages, each characterized by very distinct anatomical characters: (1) that of inflammation; (2) that of fatty transformation; and (3) that of atrophy. Fig. 22 represents an enlarged view of the tubules (450 diameters) in the stage of inflammation in Bright's disease. In this stage the kidney is of normal size, or somewhat larger; its capsule is unaltered, and strips off readily; its surface is smooth, more or less congested, often pink; it is sometimes of a dark purplish color, sometimes mottled, pale, and purple. On section the cortical surface is relatively increased in volume. It is often congested, the Malpighian bodies standing out prominently from the surrounding tissue and the congested vessels separated by a varying amount of white (somewhat opaque deposits, composed of the altered tubules). The vascular spaces between the cones and the cortical substance are uniformly distended with blood; the cones are usually redder than the cortical substance, and from the engorgment of these vessels, and the altered condition of these tubules, they present a series of alternating red and white lines converging to the apex of the cone, at which point the white distinctly predominates. The pelvis of the kidney is natural. On microscopic examination with a low power, the congestion of the vessels and the alteration of the tubules becomes more distinct; the vessels are for the most part engorged with blood. The Malpighian bodies appear as if injected with red material, or, what is more common, they appear dense and opaque, of an ashen gray color. In the earliest period of the inflammation the former condition occurs; in the more advanced period, the latter. Many of the tubules, especially those of the cortical substance, appear darker and denser than natural; they sometimes appear as solid bodies, sometimes as tubes, with thickened and somewhat opaque walls. In the groups of tubules passing down toward the cones, and in the cones themselves, individual tubules here and there are affected like those of the cortical substance, and contrast strikingly with their neighbors which are unaffected. On examination with a power of from 300 to 400 diameters, the Malpighian bodies appear dense and granular, and when the tubes expand to receive the tuft of vessels, swollen and granular cells may be seen. The tubules are more bulky than natural, their epithelium is swollen, granular and dense, the cell wall indistinct, and the nucleus frequently imperceptible. On examining a transverse section the enlargement of the epithelium becomes very apparent, for the cells are large and granular, and the lumen is greatly reduced or altogether lost. In the tubules, so altered, a transparent homogenous material is frequently seen, which fills up the lumen of the tubes, and binds together, so to speak, and cakes into one mass the epithelium of these tubules; not unfrequently blood corpuscles are associated with this exuded matter, as is shown in Fig. 22.

Fig. 23. Bright's disease. Inflammatory form second stage. Section of kidney in second stage, inflammatory form, showing the fatty opacity in the tubules and Malpighian bodies. Fatty tubules and Malpighian bodies in stage of fatty degeneration magnified 350 diameters.

In the stage of fatty degeneration or transformation, to which term "large fatty kidney" is commonly applied, the inflammatory process has passed away, or, as is more common, has become chronic. But its effects remain. The organ is enlarged; the capsule is natural, easily stripped off; its surface is smooth, or slightly depressed here and there. It is pale and fatty in color and on its surface stellate vessels are frequently conspicuous. The color is peculiarly mottled from the mingling of opaque sebaceous-looking fatty portions with the whitish, more translucent tissues natural to the organ. On section the cortical substance is pale, of a yellowish white color,

and increased in volume, while the cones are pink, and of natural color and size. The Malpighian bodies do not project prominently, as in the first stage. On closer inspection the sebaceous-looking parts may be seen to correspond to distended convoluted tubules, and not infrequently lines of this material may be seen running between the small arteries toward the cones. On microscopic examination with a low power (50 diameters), the tubules are seen in many parts distended with a black untransparent material; this is most marked in the convoluted tubules, but in the straight tubules, here and there, individuals or groups may be found affected. The Malpighian bodies are enlarged, but not prominent, and while they may be finely granular never present any black appearance of the tubules. Under a high power (300 to 400 diameters), the distended tubules are found to be filled with fatty granules, which for the most part are contained within the walls of epithelial cells, which again are embedded in a material that blocks up the tubules. The tubes, however, are found to be irregularly distended, in some parts much dilated and in others narrow and of the natural caliber. In the Malpighian bodies oil and fatty cells are frequent, but the capillary tuft is unchanged. The parts in which the fatty condition is revealed by the microscope correspond to those in which the dense-looking material is seen by the naked eye, as in Figs. 22 and 23.*

Fig. 24, a vertical section of a yellow-fever kidney from near the surface. (*a*) Albuminoid cylinders. The epithelium of the uriniferous tubules, the basement membrane, and the granules embedded in its albuminous substance, are also displayed, magnified 275 diameters.† Fig. 25, fine uriniferous tubules containing different kinds of infarctions of the yellow-fever kidney. (*a*) Albuminoid cylinder with epithelial cells, and the remaining fragments of broken-down cells embedded in the albuminoid substances; (*b*) epithelium; (*c*) basement membrane; (*d*) empty portion of the tubule with cellular tissues; (*e*) remains of nuclei and cells magnified 235 diameters.

In the yellow-fever kidney we observe a degeneration of the protoplasm of the epithelial cells lining the uriniferous tubules. This degeneration of the protoplasm of the renal excretory cells is, without doubt, preceded by hyperæmia; but this hyperæmic condition of the renal capillaries must not be regarded as the primary or the sole cause of this condition. The primary cause is to be found in the action of the septic agent or ferment of the specific contagium of yellow fever upon the protoplasm of the blood and of all the active cells of the organism, including those of the liver and the heart.

In fatal cases of yellow fever the hyperæmia of the renal vessels has become greatly diminished at the time of death by the degeneration of the protoplasm of the excretory structures, by the loss of blood through the stomach and bowels, and by the slow but progressive accumulation of the great mass of blood in the large central blood vessels during the last hours of life. When death occurs in the active stages of malarial fever the kidneys, on the other hand, presents, most generally, a hyperæmic condition and are without the fatty degeneration of the parenchyma, so strongly marked in the yellow-fever kidneys. The degeneration of the kidneys taking place in the renal parenchyma during yellow fever does not resemble in all respects the fatty degeneration of the kidneys observed in parenchymatous nephritis.

A number of infarctions found in the uriniferous tubules during the course of yellow fever represent albuminous cylinders, while others consist of the remains of disintegrated epithelial cells, or are composed of both. They are met with in all portions of the uriniferous tubules, and vary in thickness in correspondence with the diameters of their canals. The largest are found in the convoluted portions, the so-called tubuli contortæ, and in the intermediate canals, which they frequently fill up through their entire length; in the descending and ascending body and in the collecting tubules they are generally smaller. The number of these casts and the

* Bright's disease of the kidneys. J. George Stewart, M. D., F. R. S., 2d ed., p. 12-16.
† After H. V. Schmidt, M. D.

extent of their function, as well as the extent and nature of the pathological changes of the kidneys, will depend upon the length and relative severity of the disease.

Urinary bladder: As a general rule the bladder contains little or no urine in yellow fever. The urine is of a light yellow color, without any crystalline bodies, and loaded with albumin, granular fibroid matter, urate of ammonia, casts of the tubuli uriniferi and excretory cells of the kidneys. In some cases the urine is entirely suppressed for as long a period as forty-eight hours before death. So long as the kidneys perform their functions freely and regularly the patient may recover, even though black vomit may have appeared; but if the action of the kidneys has been arrested by structural changes, death is inevitable. The mucous membrane of the bladder is often congested, and in some cases ecchymotic.

THE NUMBER OF THE RED GLOBULES.

By Dr. JOSE G. HERNANDEZ,
Profesor de la Universidad de Caracas.

The classical works on physiology fail to mention the influence of latitude upon the number of red corpuscles. The author has endeavored to study this question in the tropics. He started to find the physiological mean of the number of red corpuscles in the habitants of Caracas. The latitude of the city and elevation above sea level are given. Healthy individuals, medical students between the ages of 16 and 20 years, were chosen. Twenty-five counts were made with the apparatus of Nachet. The mean obtained per cubic millimeter was 3,247,000. The minimum was 1,900,000, and the maximum 3,840,000. The amount of urea secreted in twenty-four hours was also investigated in six cases, obtaining a mean of 21 grammes, with extremes of 15 and 25 grammes. This olygocythæmia is explained by the theory that the function of the red-blood cells is respiratory and that the process of oxidation is necessary to keep up the bodily temperature, a function that must be less active where the surrounding temperature is uniformly high. The diminished oxidation of the tissues results in a diminished secretion of urea. The statement, often repeated, that the climate of the tropics is a producer of anæmia, is thus confirmed.

LA FORCE MUSCULAIRE CHEZ LES INDIENS.

Par le Dr. J. B. DA LACERDA, Rio de Janeiro, Brazil.

L'on croit généralement que les Indiens sont pourvus d'une très grande force musculaire. Nous avons eu une excellente occasion de vérifier combien était inexacte cette supposition. Pendant l'exposition anthropologique de 1882, à Rio, ce sont réunis, au Musée National, des représentants de diverses tribus, arrivés de l'intérieur du pays. Sur eux nous avons institué des expériences nombreuses et répétées, par suite desquelles il nous est resté la conviction que les Botocudos et les Cherentes ont une force musculaire inférieure à la moyenne des individus adultes de la race blanche et de la race noire. Nous avons employé le dynamomètre de Mathieu pour enregistrer la force musculaire; et nous ne l'avons enregistrée qu'après une longue série d'essais. Les plus forts des Indiens n'ont pu emporter l'aiguille au-delà de 120.

Sous le point de vue du développement des muscles il est encore notable l'infériorité de ces Indiens, comparés aux nègres. Leur agilité est à peine remarquable pour certains groupes de muscles, longuement éduqués dans l'exercice de certains actes qui font pour ainsi dire une partie intégrante de leur vie sauvage. C'est pour cela qu'ils sont très agiles dans le maniement de l'arc. En dehors de ça, ils ont des mouvements lents, paresseux. Nous n'avons pu essayer sur eux la course; malgré cela nous ne doutons pas qu'il seraient aisément vaincus par le premier venu d'autre race.

Leur mémoire auditive, en ce qui se rapporte aux sons musicaux est d'une infériorité extrême. Ils n'ont pas arrivé jamais à retenir une phrase musicale des plus simples, même après avoir été répétée devant eux une dizaine de fois.

Ils sont peureux lorsqu'ils connaissent le péril; de plus ils comptent davantage sur la ruse que sur le courage.

SUR LES TROUBLES FONCTIONNELS DUS À LA CHALEUR.

Par le Prof. J. B. DA LACERDA, Rio Janeiro, Brazil.

C'est assez important pour nous, habitants des pays chauds, de savoir comment agit la chaleur sur l'organisme, et de quelle nature sont les troubles fonctionnels qu'elle produit. A ce sujet nous avons des expériences commencées il y a déjà quelques années avec la collaboration de mon regretté collègue, le Dr. Couty, et qui sont restées inédites. Nous en allons faire un résumé, qui doit être présenté au Congrès.

Les anciennes expériences de Cl. Bernard ont été trop artificielles; elles ont été faites dans des conditions qui ne sont pas celles de la nature. Nous n'avons pas eu recours aux étuves, et nous en avons eu pas même besoin, parce que nous pouvions profiter de la chaleur naturelle. A Rio, durant l'été, nous avons souvent dans la journée des températures variant entre 30° et 36° C., les effets de la chaleur étant encore accrus par la saturation hygrométrique de l'air et les calmes de l'atmosphère.

Quand ces conditions sont réunies, on sent une défaillance considérable des forces musculaires; l'activité nerveuse reste abattue; la peau sécrète énormément; les reins tarissent; le cerveau sommeille.

Nous avons cherché savoir dans quel état se trouvait la circulation, et quelles modifications se passaient dans l'activité des nerfs sous le coup des grandes chaleurs, en faisant des expériences sur les animaux.

En prenant la tension artérielle sur les chiens, avec des températures variant entre 30° et 35° C., nous avons toujours trouvé la tension très basse. Celle-ci variait entre 12 et 15 cent. c. de mercure, tandis que dans l'hiver la tension était entre 19 et 21 cent. c. de mercure. Deux facteurs physiologiques nous ont paru contribuer pour ce résultat; la dilatation paralytique des vaisseaux periphériques et l'affaiblissement du cœur.

Une étude, aussi comparative, appliquée aux nerfs, nous a fait constater que ceux-ci, actionnés par la chaleur, étaient devenus trop épuisables. Après quelques excitations graduées de la machine électrique, ils restaient inertes. Il fallait alors attendre quelques minutes pour voir les nerfs réacquérir leur excitabilité perdue.

Nous avons aussi étudié les effets de l'insolation. Les chiens exposés au soleil, immobiles, ont crevé au bout de 50 minutes tout au plus. Les troubles du commencement ont été d'excitation: accélération cardiaque, respiration pressée; pupilles rétrécies; abondant écoulement de salive. Cela durait une quinzaine de minutes. Ensuite il commençait la période paralytique: le cœur s'affaiblissait beaucoup; les pupilles étaient larges; l'écoulement de la salive cessait; la respiration s'arrêtait pour recommencer après. Lorsque la température rectale arrivait à 44° centigrades le moment de la mort était près. Celle-ci venait par arrêt respiratoire définitif, le cœur continuant à battre, sans pousser, pendant encore quelques secondes.

Tout de suite après la mort on constatait la perte de contractilité des muscles, du moins pour les muscles respiratoires et pour le cœur. Le sang était noirâtre, assez fluide; le cœur portait des taches hémorrhagiques sous l'endocarde; les poumons étaient engoués avec des plaques hémorrhagiques parsemées. Sous la peau on remarquait un pointillé hémorrhagique, quelques fois suivi par des suffusions sanguines noirâtres.

Les modifications créées dans la circulation par l'action de la chaleur, lesquelles nous avons ci-dessus rapporté, doivent créer nécessairement deux autres conditions,

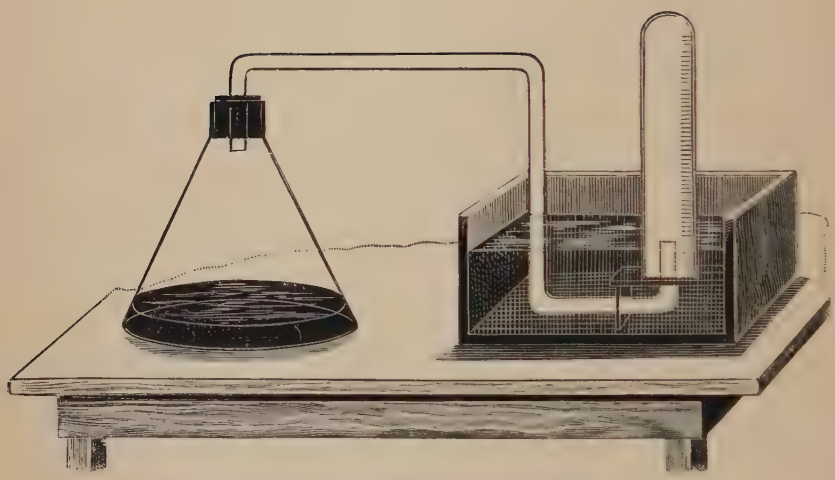


Fig. 4.—APPARATUS FOR THE ESTIMATION OF THE AMOUNT OF GAS ELIMINATED FROM FOOD.

qui n'ont pas été encore démontrées par l'expérience, c'est-à-dire, la lenteur des phénomènes d'absorption et la diminution de l'activité des échanges dans les tissus.

Maintenant il sera facile à comprendre comme ces conditions secondaires peuvent concourir à aggraver certains états pathologiques dans les climats chauds; et pourquoi, dans ces climats, on ne doit compter beaucoup sur l'absorption rapide des médicaments.

THE ANALYSIS OF THE GASTRIC JUICES FOR SOME DISEASES OF THE STOMACH.

By HUGH HAMILTON, M. Sc., M. D., of Harrisburg, Pa.

The accurate information gained by analysis of the contents of the stomach fluids in their normal condition, when the stomach is empty or in functional activity, is attractive to the physiologist because it places his work in a practical field; of benefit at once to the physician and his patient. One of the first indications of disorder of the stomach is the distension of the organ until the fermentive gases force their way through the cardiac orifice, sometimes carrying portions of the fluids or semidigested food with it. The flabbiness of the stomach walls themselves might be a cause of distension, but the ingestion of an abundance of easily fermented food only emphasizes the condition. The object of this thesis is to apply absolute methods to these phenomena, such as the exact volume of the organ, a way of determining the fermentive capacity of the food as a factor; the estimation of the HCl in its several combinations; the intermittent (functional) or continuous emission of stomach juices. The volume of the stomach measured by means of its capacity to contain a given amount of air at a pressure until it gives way has taxed the ingenuity of those interested. A recent simple apparatus is that of Dr. Kelling, of Dresden. (See Fig. 1.) In his investigations he elaborately entered into the details of the difference of water volume exceeding that of the air volume capacity of the stomach. In his cases the average was 72.3 per cent.

FIGURE 2.

Case.	Age.	Height.		Weight.		Volume of water.			Pressure.		
		c. m.	*Ins.*	*Kilos.*	*Lbs.*	*c. c.*	*Qts.*	*Pts.*	*c. m.*	*Inch.*	
1	19	117	50	69	151	1,500	1	1	20	>8	K
2	30	168	67	805	177	1,400	1	>1	22	>9	A
3	28	173	69	695	154	1,200	1	>1	17	>7	R
4	18	182	72	76	167	1,560	1	<1	22	>9	F
5	39	171	68	85	187	1,600	1	<1	20	>8	L
6	40	165	66	55	121	1,300	1	>1	21	>9	Z
7	35	165	66	62	135	1,860	1	<1½	16	<6	C
8	60	165	66	73	146	1,250	1	<1	17	>7	H
9	50	167	67	65	130	1,100	1	<1	20	>8	F
10	56	173	69	87	165	1,700	1	<1¼	19	>9	G
11	47	183	73	100	200	1,300	1	<1	22	>9	T
12	40	160	64	170	140	1,200	1	<1	21	>9	L

REMARKS.—7, 8, 9, 10, 11, and 12 are my own observations.

To estimate the fermentive conditions, a portion of the stomach contents is withdrawn after definite meals, in periods ranging from one to four hours, then the ingesta placed in a bottle and raised to the temperature of the person's body, kept there until fermentive action ceases, or for a given time, when the oven into which the bottle has been placed indicated the average proper body temperature of the particular individual. The bottle or flask is connected with the following shaped apparatus (Fig. 4), and the amount of gas eliminated from the food mixture read off at designated intervals. The abscissa of a scale may indicate time, while the ordinates will show the number of cubic centimeters of gases that may be caught over mercury

or water, depending in some cases upon the nature of the principal gases forming the volume of the effluvium (Fig. 5).

7 P. M., May 24, 1892, case (BR) of continuous secretion of the stomach juices.—The organ at rest contained about 1,300 c. c. After a mixed diet of meat, bread, and milk, 100 c. c. of this food was withdrawn, with the following results. Meal was taken between 6 and 7:

At 7 hours—	c. c.	At 7 hours—	c. c.
5 minutes		40 minutes	20.7
10 minutes	3.4	45 minutes	22.8
15 minutes	6.5	50 minutes	24.5
20 minutes	9.6	55 minutes	26.7
25 minutes	12.6	60 minutes	28
30 minutes	16	June 9	26.1
35 minutes	18.4	June 18	32.5

Various diets affect the amount of gas production.

Remedies for interrupting fermentation and scale of their value.

In 12 hours—	Cubic centimeters of fermentive gases.	In 12 hours—	Cubic centimeters of fermentive gases.
Acid, salicylic, emitted	0.0025	Carbolic acid emitted	0.01
Natrium salicylate emitted	0.0025	Creosote emitted	0.05
Natrium benzoate emitted	0.03	Boric acid emitted	1.00
Saccharin emitted	0.05	Alcohol emitted	5.00

In these experiments it has been found that one drop hydrochloric acid added to 10 c. c. milk gave 9 c. c. of gas in 12 hours due to fermentive action.

Hours.	Gas.
2	9 c. c.
3	9, and with Congo paper showed 4.2 per cent acidity.
4	5.75, and with Congo paper showed 8.6 per cent acidity.
8	None in 3 to 4 or 12 hours afterwards.

The remedies here are obviously salicylate and benzoate of soda, and in certain conditions small quantities of hydrochloric acid. The acidity of the stomach juices and its proper therapeusis is a fertile source of discussion. The mere fact of its presence by its effect upon certain "indicators" is at best of a qualitative index. The best methods of quantitative estimation are rapid volumetric ones, they give most conclusive results. We first find the total acidity by triturating 5 or 50 c. c. of the stomach contents with a $\frac{1}{10}$ normal alkaline solution. With an indicator this will give you, for example, 0.182 "A." The total acidity, if made up of the free and organically combined HCl would be exactly the same as the sum of these factors; but the amid-group acids qualify it at different times so that the factors vary considerably during digestion. This may be deferred until later.

The factors of investigation are—

A. Total acidity.
T. Total HCl.
F. Fixed HCl (salines).
C. Organic combinations of HCl.
H. Free HCl.
a = value of amid-group acids.

Fifteen cubic centimeters of the filtered contents of the stomach are divided into three portions, the first of which (a) is dampened with a clear, saturated solution of $NaOCO_2$ and dried with the other portions (b) and (c) over a water bath. Then (a) is taken out, exposed one minute to a weak red heat, taking care that the sub-

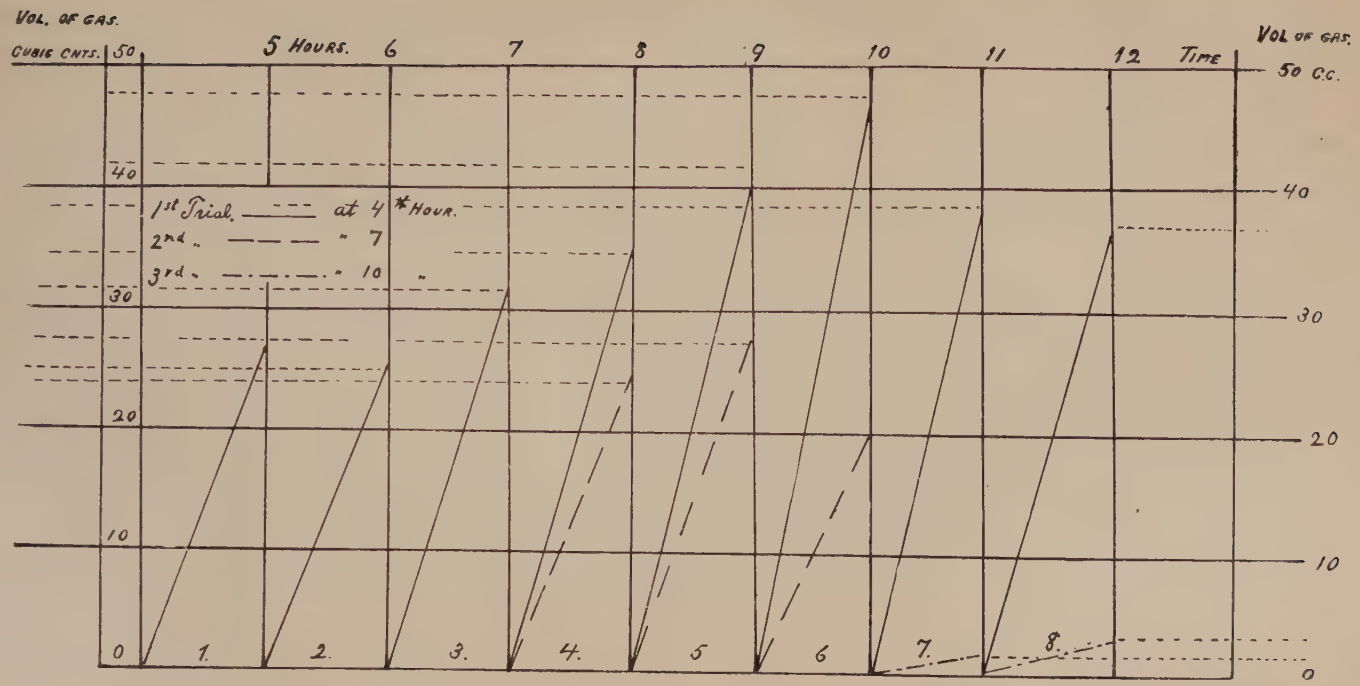


FIG. 5.—PROGRESSIVE FERMENTATION OF FOOD.

The volume of gas in c. c. formed from the contents of the stomach taken at three periods, being subjected to a temperature of 38.8° C. from hour to hour upon 100 c. c. of the fluids.

stance is heated until totally colorless and white. After cooling, dissolve in distilled water and add a little clear NO_5 to drive off the CO_2; dry and neutralize with CaO or $NaOCO_2$; then filter and wash the residue with boiling water, and triturate with $\frac{1}{10}$ normal solution $AgONO_5$, indicating by $KOCrO_3$, known as "T" = *total chlorides.*

(*b*) This portion is dried an hour (*per se*) at 100° to 110°. When totally dry, the residue is wet with a clear saturated solution of $NaOCO_2$, and treated as in (*a*). This is considered the combined chlorides = organic and fixed chlorides "C" + "F."

(*c*) This portion is dried and burned; the HCl found in ash is considered *fixed* chlorides. "F."

Portion (*a*) is designated as total chlorides, A, (*b*) is designated as the mixed *chlorides* of organic substances and fixed chlorides; hence (*a*) — (*b*) = free HCl as difference known as "H;" and (*c*) is known as the fixed chlorides, i. e., salts, as "F;" then (*b*) — (*c*) = organic chlorides known as "C."

Chlor-uric evolutive disturb.	Chloro-hydria or glandular reactive process.	Qualitative changes in peptonization.
T.; F.; $\frac{T.}{F.}$	C.; H.; $\frac{C}{H}$	A.; a.;

I. H + C greater than normal = $\frac{C}{H}$ = Hyperpepsia.

II. H + C normal = $\frac{C}{H}$ = *Normal.*

III. H + C less than normal = $\frac{C}{H}$ = Hypopepsia.

This is the best explained by the following tables:

$$H = T - (F + C)$$

$$a = \frac{A - H}{C} = \text{I or less than I.}$$

Minutes.	Total chlorides (T).	Fixed chlorides (salines) (F).	Free, HCl (H).	Organic comb. HCl (C).	Total acidity (A).	Value of (*a*).
30	255	182	0	73	75	102
60	321	109	44	168	189	86
90	284	164	14	106	126	105

I. *Hyper-pepsia* ..... $\left.\begin{matrix}C\\H\end{matrix}\right\}$ +

a. General ..... $\frac{T}{F} = 4.5$

b. Chloro-organic ..... $\frac{T}{F} = 3.1$

c. Hyper chlorhydria ..... $\frac{T}{F} = 3.$

II. *Normal* ..... $\left.\begin{matrix}C\\H\end{matrix}\right\} =$

III. Hypo-pepsia ..... $\left.\begin{matrix}C\\H\end{matrix}\right\}$ — to O.

A = < 1 or > 1 or O

a. $\frac{T}{F} = 3.7$

b. $\frac{T}{F} = 1.5$

c. $\frac{T}{F} = 1.4$

A. Normal acidity—0.1 to 0.2 per cent HCl.
Nervous dyspepsia.
A. Sub-normal. Below 0.1 per cent HCl.
Sub-acute, Chronic, Carcinoma } Ectasie or atony of the organ.
A. Supra acidity or abnormal above 0.2 per cent, likely ulcer, HCl.
Gastritis—
Differential Diagnosis:
Cancer the A. < O.
Ulcer A. > 1.

Glandular or parenchymatous gastritis.	Irritation of the upper cells.	Hyper-pepsia with supra abundance of HCl.
	Mucous irritation of great cells.	Hypo-pepsia with a-pepsia.
	Atropy of glands, a-pepsia.	
Interstitial gastritis.	Simple, glandular atrophy, in whole or partly.	Hypo-pepsia to a-pepsia.
	Mixed irritation with glandular disturbances.	Decided hyper or hypo-pepsia.

To sum up the matter in the increased size of the organ, its capacity to endure strain shows the reasons for its dilatation are either a yielding of the walls or the continuous fermentive process. After defining these facts by absolute methods we have a means of relieving the disease with the action remedies, other things being equal, with comparative certainty from the information gained respecting anti-fermentives, as sodium salycilate or benzoate.

Respecting various painful dyspepsias it is important to fill the organ (it should not be overstrained), discover its weak and tender spot, and test the contents for acidity, A., which to a degree fixes the sort of soreness you have to deal with, whether benign or otherwise. The use of remedies such as pepsin or hydrochloric acids are matters that are exhibited with accuracy in the formulas shown respecting the different states of HCl in the contents of the stomach, as in the hyper, hypo, or a-pepsia states.

I trust that these few demonstrated clinical certainties may lead to a more sure method of treatment.

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PRELIMINARY NOTE ON THE PHYSIOLOGICAL ACTION OF LANTHANUM, THORIUM, ITTRIUM, PRASEODYMIUM, NEODYMIUM, AND ZIRCONIUM.

By ISAAC OTT, M. D., of Easton, Pa.

The salts of these metals were procured from the Welsbach Incandescent Light Company, of Gloucester City, N. J. The nitrates were the combination used, and were soluble in water. The two bodies, neodymium and praseodymium, are two new elements separated from the old dedymium body by Dr. Van Welsbach in 1885. Their atomic weights were determined by Bunsen and Welsbach. The experiments were made upon frogs and rabbits.

The first element I shall take up is lanthanum, which was combined with ammonium to make it soluble in water. In the frog in one-half grain dose subcutaneously it increased the respirations and caused a feebleness of movement with a tetanic action, and finally all sensibility is lost whether the artery is ligated in one leg or not. Motor nerves when exposed are irritable; chest opened, and heart beating 34 per minute. In the rabbit, when a grain is gradually injected per jugular the pulse rate is hardly altered, but the arterial tension falls. The respirations continued after the heart stopped, while in another instance the heart was beating feebly five minutes after the respiration ceased.

THORIUM NITRATE.

A frog received at various intervals 20 grains subcutaneously. It caused increase of respiratory movement, then convulsive movements of the posterior extremities. There is a feeble response to strong irritation of the skin. The animal died in an hour and twelve minutes, heart beating 36 per minute. Sciatic irritable.

A small rabbit received one-half grain thorium nitrate per jugular. Respiration at first accelerated. In two minutes after spasmodic movements of the posterior extremities the breathing ceased, heart beating 100 per minute.

When a rabbit received an eighth of a grain at various intervals, it did not alter the pulse rate to any great extent, but depressed the blood pressure.

ITTRIUM NITRATE.

A frog received subcutaneously 12 grains of ittrium nitrate. In twenty-three minutes he sits in a stupid condition, with eyes closed, but jumps when his legs are irritated. Lies with mouth open; finally does not respond to irritation, heart beating 40 per minute. Has convulsive movement of legs. Sciatics irritable.

In the rabbit one-eighth of a grain per jugular lowered the pulse rate and pressure.

ZIRCONIUM NITRATE.

After injection of 38 grains of zirconium subcutaneously the frog crawls in a weak manner when irritated. Chest opened, heart beating feebly at 36 per minute; sciatics irritable.

In rabbit zircon did not perceptibly alter pulse rate, but depressed arterial tension.

PRASEODYMIUM.

A frog after he received 24 grains of praseodymium had increase of respiration and jumped about convulsively. When 12 grains more given subcutaneously he had convulsions, and at length responds very feebly to strong irritation. When 6 grains more were injected he died; chest opened, heart beating strongly 44 per minute; sciatics irritable.

In the rabbit ½ grain per jugular caused no marked alteration in pulse beat, but a depression of arterial tension. Praseodymium is stronger than neodymium.

NEODYMIUM.

In the frog 20 grains subcutaneously soon caused loss of movement; severe irritation produces convulsions and death; heart beating 34 per minute; sciatics irritable. In the rabbit 4 grains per jugular caused depression of pulse and arterial tension.

The following conclusions can be drawn from these experiments:

(1) That in cold-blooded animals they cause loss of motility and a loss of sensibility, which is in part cerebral.

(2) That they all depress arterial tension and not markedly alter the movement in warm-blooded animals.

(3) That in cold-blooded animals the heart continues to beat after death, but at a lower rate of speed.

(4) That praseodymium is a more toxic agent than neodymium.

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ADDRESS OF THE PRESIDENT OF THE SECTION.

WHOOPING COUGH AS SEEN IN THE ROCKY MOUNTAINS.

By J. M. KEATING,* M. D., LL. D., of Colorado Springs, Colo.

President American Pediatric Society; President Section of Diseases of Children, Pan-American Medical Congress; Fellow of the American and British Gynecological Associations, Etc.

The honor which was conferred upon me by the request to organize this section carried with it a responsibility which I fully realized, and, under other circumstances, I would have hesitated in accepting the trust, living, as I do at present, in a section so far removed from those who would be my active coöperators. But, with the aid of one so efficient, so energetic as our secretary-general, Dr. Reed, and with the active assistance of our secretary, Dr. Crandall, I felt that our meeting was bound to be a successful one, and I was proud to be its standard bearer and to give all the aid of my enthusiasm in the good cause. What more attractive study is

* Since deceased.

there than that of pediatrics? What more interesting theme than that which relates to the growth and development of the healthy babe, who will in future bear upon his shoulders the responsibilities of the world—those that relate to family and to government? What more satisfactory study than that of disease at an age when all natural processes are in our favor? The very subjects of which we write are those that are nearest and dearest to us in our individual homes, for they touch our love as well as our sympathy. They teach us how to defend those little ones from the aggressive influences of diseases which luxury and avariciousness have brought into our midst. They teach us the cause and, by knowing it, we learn its cure. The object of this congress has been to bring together all the workers in the vast field of medicine in this great hemisphere, and we hope by the happy association of scientific meeting and social gathering to learn more of the effects of climate on disease, both in its causative and curative relations; to study also the effects of individual resistance through racial peculiarities probably due to climatic influences—a subject which is looming up as one of vast importance.

I desire to call your attention to the subject which I have chosen for a few remarks to-day, hoping that it will bring forth some discussion and that the investigation which I have undertaken may prompt others to follow out this same line of thought in connection with other diseases of children in the various sections of this great country. Since living in Colorado, after having had quite an extensive practice on the Atlantic Coast, I have been very much struck with the differences in various affections of childhood with which I had been previously very familiar. These differences certainly were not due to peculiar conditions of the individual, which might be said of those who are phthisical and who had congregated in large numbers at certain favorable places and where certain common symptoms might depend upon the disease and not the climate; but in children who, as a rule, are healthy subjects, peculiar manifestations of disease undoubtedly depend upon local influences, which may be either those of soil or those of climate. For this purpose, I addressed myself to a number of prominent physicians of Colorado and New Mexico, and have collected considerable data, from which I take the material for the paper that I present you to-day. It is not necessary for me to dwell at any length upon the subject of whooping cough. You will find all that I have to say upon this subject in the article in Pepper's System of Medicine and in a recent publication, Mother and Child. I may say that I believe the disease to be microbic in character and capable of being influenced by treatment that will reduce the attending laryngeal and tracheal catarrh and act as sedative upon the nervous system. We have all noticed that children do best with whooping cough who live in the open air and, for that reason, it is always recommended, when possible, to send our cases to the country or to the seashore, to dress them in flannels so as to prevent the catching of cold, to let them lead lives which are invigorating and which will tend to fortify their digestive processes; in other words, that with fresh air and tonic influences the disease will run a mild course and terminate in recovery.

The great question which has often attracted attention is whether the violent paroxysms which one so often sees attending this disease, and which result in hæmorrhages, at times most alarming, are productive of organic changes in the heart and lungs which will seriously impair them as to growth and development. It must be said that at times we do meet with cases of this character, and possibly for years these little ones will be affected with evidences of cardiac strain or emphysema that will require the most careful attention to overcome so as to bring them to the standard of a healthy adult. But if that is so for those who live upon the sea level, how is it for those who live upon the vast slopes of the Rocky Mountains over one mile high? It is not necessary for me to go into the dynamics of altitude. The writings of Denison and Solly in this country, and Theodore Williams in England, have proved conclusively that the attenuated atmosphere, or, in other words, the relief from atmospheric pressure, has a marked influence in increasing the necessity for pulmonary activity and influencing the heart to a very great extent. The respira-

tions are either increased in rapidity or rendered deeper and the pulse rate is quickened until an equilibrium is maintained. The necessity for a larger supply of air naturally lays a greater strain upon the heart and lungs upon exertion, and one would imagine that where any interference would take place through spasms of the glottis the force of the expiratory effort would be intensified under the conditions named. We find also in studying disease in the adult in high and dry localities that the bracing winds and remarkable electrical phenomena of the atmosphere produce a nervous condition which seems to intensify those affections which have in them more or less of a marked nervous element.

Of course one finds that the so-called nervous temperament which is associated with anæmia is benefited by an out-door life, which gives appetite and helps to increase the blood, both in its amount and richness, and such cases seem to do well. But the essentially neurotic type of individual—and I am speaking more especially for the women, as they form the larger part of my practice—are apt to suffer from insomnia, irritability, and all such evidences of excitement. I have also noticed in a few cases that children are more or less subjected to the same influences, and certainly with them we must be able to study more satisfactorily the effects of climate, because they are less influenced by what they hear and by dissatisfaction with their surroundings. I have had two most interesting cases of spasmodic asthma—one in a child born here, who is ten years old, but who developed the disease in early childhood, and who became more and more affected as she grew older. She was highly excitable, intelligent beyond her years, and of an essentially neurotic type. The parents were both perfectly healthy. Exposure to the wind when driving would bring on the most severe attack of asthma I ever saw in any individual, which would last for several days. She would become highly cyanotic, the pulse would become extremely irregular and intermittent, the respiration very frequent and very shallow, and, indeed, on two or three occasions I felt that it would be impossible for her to survive the attack. Upon removal to the Atlantic Coast the child has remained perfectly well for now a year. One would then naturally suppose that in this section of country the spasmodic element of pertussis would be much increased; in other words, that the nervous system would be rendered more susceptible to the influences of the disease.

One of the most interesting descriptions—and from my long residence in the locality I can vouch for its accuracy—is the paper on "High altitudes and their climates" by Theodore Williams, read before the Royal Meteorological Society of London January 18, 1893. In the description of the climate of Colorado taken from this paper we find that in regard to rainfall it varies from 8.71 to 22.30 inches; at Denver, 14.17; Colorado Springs, 15.17; Santa Fé (the capital of New Mexico), 14.17 inches; at Gunnison, which is 7,680 feet, 10.02, and at Leadville, 10,200 feet, only 12.80 inches. Throughout Colorado scarcely any rain falls from October until May, and during the months of July and August most of the precipitation occurs, at which times thunderstorms are of frequent occurrence. Snow, which occasionally falls in the autumn and winter, rarely does so to the depth of more than a few inches, and only in the mountains does it remain for any length of time. The relative humidity, of course, varies with the season of the year. For two-thirds of the year it is remarkably low; for the other third, when the rain storms are frequent, the average is brought up so as to bring a percentage varying from 46 to 58. As the number of days in the year in which rain falls is calculated to be about 85, and on most of these there is simply a thunderstorm and the rest of the day perfectly fine, the amount of sunshine is simply remarkable, and permits one to remain out of doors practically most of the year. One of the results of this out-of-door life is the remarkable resistance to attacks of bronchitis, which seem so prevalent in the East, as the result of exposure to sudden changes. Children rarely take cold, and yet the changes are remarkably sudden. At sundown in winter the mercury may fall within an hour or so 30°, 40°, or 50°; but probably the excessive dryness of the atmosphere is in itself the cause of the immunity to the acute catarrhs, both laryngeal

and bronchial, so prevalent in a moister and lower place. In order to find out what influences, if any, these atmospheric peculiarities and also altitudes had upon a disease like whooping cough, I have collected and present to you the experience of a number of physicians, who have kindly replied to my circular letter. These I give, as follows:

Name.	Place.	Altitude.	Experience.
		Feet.	
P. J. McHugh	Fort Collins, Colo	6,275	No special change from text-book account.
Hubert Work	Pueblo, Colo	4,600	No special data.
J. M. Sleicher	Walsenburg, Colo	6,275	Great many cases terminated in pneumonia following measles epidemic.
John Symington	Santa Fé, N. Mex	7,027	Mild; rarely complicated.
B. P. Anderson	Colorado Springs, Colo	6,000	Attacks mild.
Le Kahn	Leadville, Colo	10,600	In something like 20 per cent of cases have noticed some heart strain, and in about 5 per cent have detected valvular trouble, though in most cases it is not severe. Have had one case only of pulmonary emphysema following whooping cough, and that was a child of 5 years. Have never noticed asthma as a consequence of whooping cough.
E. A. Lea	Fort Collins, Colo	6,275	Nothing to note.
B. A. Arbogast	Breckinridge, Colo	9,524	Whooping cough more mild, with rather an extended period of catarrhal symptoms.
T. H. MacNaught	Denver, Colo	5,000	Whooping cough cases are mild, with few complications or sequelæ.
L. M. Griffin	Boulder, Colo	5,200	Whooping cough I find more fatal, through complications and neglect upon the part of parents, than one ought to expect. Pneumonia, progressive; emaciation and cerebral congestions.
E. Stuver	Rawlins, Wyo	6,307	We only had one epidemic last winter; disease severe; quite a number of young children died.
A. T. King	Pueblo, Colo	4,600	Whooping cough less severe; complications about average; sequelæ less grave.
Frank Tinny	La Junta, Colo	4,060	More severe than in eastern Kansas.
James Wroth	Albuquerque, N. Mex	4,950	Whooping cough much milder; only fatal case a child two weeks old, disease appearing first week of life.
P. D. Wrathwell	Denver, Colo	5,000	Our fatal cases complicated with pneumonia.
N. Wiest	do	5,000	Have had great many cases in private and hospital practice in Denver; find the disease milder by far, but very persistent. No important complications or sequelæ.
N. W. Bellrose	Eaton, Colo	4,822	Only one case—boy of 4; good recovery.
John Gaw	Leadville, Colo	10,000	Generally mild, without complications or sequelæ.
Francis H. Atkins	Las Vegas, N. Mex	6,450	No variation from standard of sea-level types has been observed; no sequelæ. Have lived 20 years in the great plains, 13 in New Mexico, and 8 in Las Vegas.
H. B. Moore	Colorado Springs, Colo	6,000	Nothing peculiar in its clinical course.
F. H. Lay	Denver, Colo	5,000	Mild complications and sequelæ rare.
J. N. Hall	Sterling, Colo	3,900	Saw an extensive epidemic in Sterling, with no death or serious complications.
N. D. Estes	Alamosa, Colo	7,584	Whooping cough has been mild, unattended with complications; no deaths.
Jesse Hall	Greeley, Colo	4,750	Very mild; few cases, no sequelæ.
F. Bancroft	Denver, Colo	5,000	Whooping cough (last epidemic) very severe one; 8 to 10 years age quite severe.
J. H. Finfrock	Laramie, Wyo	7,400	"Nine months winter and three late in fall." Whooping cough common and mild; never knew of a death; often prolonged; complicated, with bronchitis.
Charles Denison	Denver, Colo	5,000	Worse in some cases because of mechanical effect of rarified air favoring emphysema.
James A. Hart	Colorado Springs, Colo	6,000	Have practiced twenty years in this locality, and found the disease about as represented in the text-books. Some epidemics severe and some mild.

We have thus endeavored to ascertain the views of those who are pretty well scattered throughout this section at various altitudes, and though it is absolutely impossible to give a positive reply to the questions asked without a record being kept of cases, as should be done if scientific work is to come from our daily experience in the future, every man is impressed more or less with the character of the cases which have come to his notice, and these statements which I have just quoted possibly represent the facts as they really exist. We may then conclude that there is very little difference in whooping cough as seen in this section from what we have been accustomed to note on the Eastern coast, and that the little difference is possibly dependent upon epidemic influences. The most serious complication certainly seems to be pneumonia, and though this is a complication which is to be feared everywhere, it has the greatest significance in an altitude where pneumonia as a rule is a very fatal disease. In New Mexico, according to Dr. Francis H. Atkins, who is a well-known writer on the climatology of that section, sequelæ are rare. Dr. James Wroth, of Albuquerque, whose experience is most reliable, also dwells upon the extremely mild character of the disease. Dr. John Symington, of Santa Fé, whose practice has been an extensive one for many years, speaks of the disease as being mild and rarely complicated, and this at an altitude of over 7,000 feet. But that mildness of climate has very little to do with this result is shown in the statement of Dr. J. H. Finfrock, of Laramie, Wyo., at an altitude of 7,400 feet, who quotes Bill Nye's description of their climate as "Nine months winter and three late in the fall," in which he notes that whooping cough is common and mild, but that it is frequently complicated with bronchitis, which could be expected in so rigorous a climate.

In summing up we may therefore conclude that as the cases of whooping cough receive their greatest benefit from living in the fresh air on the sea-level, so possibly it is the amount of fresh air and outdoor life which mitigates its severity on these mountain slopes; that in children who are healthy altitude of itself does not seem to influence to any very great degree the strain of the cough in the production of heart trouble or seriously impair the lung structure; that the robustness and resiliency of youth soon combine to maintain the balance of the circulation, and that also the nervous system of the child, though more impressionable to reflex irritations, does not seem to be so susceptible to climatic influences as that of the adult.

PAPERS READ BEFORE THE SECTION.

THE INSANE DISORDERS OF CHILDHOOD.

By JOHN MADISON TAYLOR, A. M., M. D.,

Professor of Diseases of Children, Philadelphia Polyclinic; Professor of Diseases of Children, Medico-Chirurgical College; Assistant Physician to the Children's Hospital, Assistant Physician to the Orthopedic Hospital, Neurologist to the Howard Hospital, Fellow of the College of Physicians, Secretary of the Philadelphia Neurological Society, etc.

It comes in the way of those who see much of children's diseases to meet with many cases of what I prefer to call insane disorders. A consideration of these, rather in the line of their nature and requirements than elaborate speculation as to causation and phenomena, may prove of use to the practical physician.

Insanity arising from the same sources whence it comes in the adult is rare in childhood, but mental defects are only too common, and grow worse with startling rapidity unless most wisely handled. Minor mental deflections or shortcomings which may escape attention form the fertile ground for ineradicably evil mental attitudes to take ready root. Active disease frequently disturbs the cerebral functions,

and these may not recover with the subsidence of the acute process, even though the structural damage be small. When this occurs, it is important carefully to direct even the simplest educational and disciplinary measures in order to inhibit further lapses and regain healthy tone. In a long experience in dispensary work among children such cases have occupied much of my attention and certain principles of guidance have become formulated in my mind, which may be trite enough, but nevertheless prove of service to others.

My purpose is to call attention to the casual factors which should be scrutinized by the physician so soon as the least ground for apprehension arises, and after a general consideration of these point out how to deal with suspicious phenomena. The causes of these states are many and of wide reach. Some are the outcome of depressed physical powers due to want and misery; many more, however, are the result of careless usages, complications, and vice. In certain parental tendencies there lies danger. Vitiated appetites, as for alcohol, opium, or even tobacco, interlace with other, or are themselves a ground for, diseases of body as well as of mind. Tuberculous families frequently present instances of acute nervous diseases, terminating in swift fatalities, and offer also little resisting power against exciting causes. Then there are families of notably unstable nervous equilibrium in whom acute diseases or overwrought emotions work sad havoc. Cultivation of the emotions in the way of mundane or heavenly things, or, per contra, an undue asceticism or self-repression, may exercise a hurtful effect upon the offspring. When these various causes thus sketched out, and of limitless scope and variety they are, become superadded, one to the other, by the marriage of a tuberculous father to an hysterical mother, or an alcoholic father to an overconscientious, highly spiritual mother, disaster may be predicted for the issue. Again, upon the impressionable nature of developing nervous tissues of a child hypersensitive by heredity, exciting causes act only too overwhelmingly. Influences capable themselves of disturbing even a healthy-minded child are many. Acute febrile diseases produce commonly delirium, which is itself a transient insanity, and this may pass utterly and quickly away, or leave an indelible stain on the cerebrum. That surprising condition which we regard as accidental, because as yet we do not know how to explain its origin, known as precocity, is a source of peril if not an evidence of mental unsoundness. It is almost never a ground for parental gratulation, and only rarely fulfills youthful promise and not seldom predestines its possessor to neurosis.

The childish brain is very vulnerable at all times, and demands for its best development slow and undisturbed opportunities and wholesome conditions. Very much mental stimulus is always hurtful, although pure intellectual pushing is said by Charcot to be in itself incapable of harm, provided other wholesome physical and moral conditions are maintained. The emotions evidence themselves first in mere animal delightedness, even then running along the lines of ancestral traits. Here the parental coloring of mind, habit, or exterior is shown in curious faithfulness of detail. Even at this stage bad habits may become sketched in upon the impressionable receptive centers, which, either encouraged or neglected, form the ground for future calamitous happenings. The exciting cause of mental disturbances differ in some respects from those of the adult. One of the most serious is rapid alternations of temperature. Children notably bear heat and cold less well than grown folk, and a baby laid with its head defencelessly toward a hot stove has in several instances been driven into acute mania. Children bear pain unusually well so far as mental distress goes. Much attention has been drawn of late by rhinologists to adenoid growths of the naso-pharynx as a cause of mental degeneration. Disorders of the digestive organs may form fundamental perversions which result in a series of reflex irritations, setting up, usually, only transient disturbances of mind. The cause being removed, recovery ensues. Intestinal parasites cause a variety of nervous troubles, but very rarely actual insanity. Hurtfully directed moral causes are very efficient factors in disturbing the mind, both temporarily and more seriously. The shock of fright or overwhelming dread is powerful for harm even in

children perfectly healthy. Religious teachings of a lurid hyperbolic type act as a lever by which great harm is wrought. As a potent accessory factor superstition has in all times been an agent to dethrone unstable minds. Acute disease is a fertile source of harm; a scarlet fever, or typhoid, especially if accompanied by hyperpyrexia, very often reduces a perfectly healthy, vigorous child to an imbecile or a maniac. Masturbation was credited with overmuch power for mental harm, but is certainly responsible for some. A brutal, drunken father, aside from prenatal conditions, causes terror and woe to young children, as well as perverted morals. Example is almost as powerful for harm as ancestral traits.

Children subjected to long periods of want and exposure are certain to fail of right development and to bear some stain in the moral senses if not in mental acuity. Hence, the waifs and strays gathered up by the municipality or by philanthropic societies are of questionable mentality and demand unusual care in implanting the seeds of morality and right conduct. These must receive a more primitive form of instruction than others who have enjoyed a better start in life. The fundamental concepts being at fault, too advanced instruction only confuses.

To come at a statistical knowledge of the prevalence of mental disorders in children will always be hedged about with grave difficulties. Parents are not usually watchful as to these states, and are even more rarely competent observers to interpret mental deflections and shortcomings. Moreover, if a suspicion arises in a mother's breast as to the mental soundness of her offspring, it is likely to be tight locked therein and shared with no one living, until the conviction is reluctantly forced upon her consciousness from repeated overt acts. Moreover, it is rare to meet a mother capable of rightly training a child not altogether wise. Some, happily, are admirably gifted in this respect, and if the mother is capable of being or will submit herself to be carefully instructed how such a case shall be managed sometimes the very best results come from home care. It has been my experience to see some excellent instances of these mothers, and I am inclined to believe that this particular possibility may be very much amplified. Again, I have found immediate relatives who both could and would undertake this care, and bring about excellent results. As a rule, the mother is so hampered by her emotional view that her judgment is not good in respect to her own child. Then, the problem arises to whom it may be committed. It has been my custom, and I think from it some excellent results have come, to always search about among the home possibilities of such a case, and not seldom there has been found some good maiden woman, or widowed aunt, or childless person, who could be taught to do what the same child's own mother might be able to do for some other woman's child. We have before us always the admirable example of the insane colonies of Europe, where such excellent results come from treatment in private houses, and whenever this can be accomplished it is better so to do. The well-regulated asylum is abundant for good, and of the excellent specially instructed folk who rule therein I have little to say but of praise.

My theme here is the conduct rather of those who may not enjoy these advantages, either because they are not adjudged fit subjects or whose people decline to send them there. Moreover, the great body of mental suspects who escape statistical record is at the mercy of the family doctor, and upon him lies the responsibility of directing their care and teaching. Hence the bulk of these are to be treated at home and the average medical man enjoys a grave privilege.

In questioning, examining, and otherwise dealing with the child as a neurotic patient, success in arriving at right conclusions depends as much on the demeanor and conduct of the physician as on his knowledge. With the adult this may possibly not be true, but in respect to the less differentiated mental organization my proposition will hold. Skill born of much experience is needed to win the confidence of a child, and to this must be added tact and gentleness. Here again, gentleness should not lack a strong infusion of firmness and decision. If the patient be one whose mind or disposition is disordered it is of double importance to approach the

problem aright, either to learn essential facts or to apply remedies. Medicines will often be quite needless, but moral control and tactful domination must be ever forthcoming. The physician should succeed in impressing his personality upon the patient. He must represent embodied power, helpfulness, and justice. In some instances he may be of loving manner, pleading with the obstinate but sensitive nature. More often he needs to pose as a kindly yet overmastering being, to whom confession must be made soon or late. Again, over voluble, highly graphic confessions must be discounted too. Always obedience must be exacted, but tempered by due consideration of immediate necessities, and no more. Gradually simple yet systematic measures may be given shape and pushed steadily to an end. Much tactful shifting of unessential measures are at times demanded, patience and firmness always.

The insane disorders, as the term is used here, is meant to include not only insanity, but that mixture of insanity and hysteria which is ofttimes indistinguishably blended. Nor must hysteria in the larger significance of the word be excluded. Hysteria in imitating as it does all neuroses yet never presents a picture faithful in essential details. It offers the more superficial appearances, but is wanting in the testamentary clinical findings. The faults have especially to do with the phenomena of onset; also with the basal symptoms such as evidence structural change and with the true course of the disorder imitated. Hysteria, while preëminently an imitation, is not all, nor nearly all, true simulation. In children it is rarely suspected, but always possible so soon as the receptive faculties and power to form concepts are fairly established. The heedless examiner will often give to the shrewd observation of the hysterical or insane child leading points on which to fashion its symptom groups by his idle words and leakage of thoughts while thinking aloud, and may be thus misled afar. Moreover, the distinction between these closely resembling conditions is oftentimes a purely relative matter, to be decided partly by the personal factor of the observer or the social or individual standard of the patient. Again, hysteria and organic brain disease may coëxist, not often in the child, 'tis true, but will there prove most puzzling.

Moral perversions are hard to distinguish from merely evil and vicious tendencies which are acquired by a stupid, impressionable subject. The moral imbecile is inherently bad. He is an instinctive liar and thief, cunning and skillful in mischief-making, and if in other ways seemingly competent, yet unspeakably provoking to the parent or teacher. To know how to best deal with such is generally conditional upon a clear decision as to whether one has to do with an ineradicable vice or disease, here probably synonymous, or a possibly removable disorder. The main thing is not to attempt too elaborate a plan of improvement, and when he be under favorable surroundings to exercise infinite patience and use abundant time. He is to be made to know that while not to be trusted or believed the utmost encouragement will be enjoyed so soon as evidences of improvement are shown.

Along with obviously wicked acts coëxist often evidences of disease process as convulsions. It is often most difficult to determine if these be epileptic or hysterical. These may be in combination, too; hysterical attacks in an epileptic subject is a blending to which there is no key. Typical clear-cut cases of neurotic maladies are none too common, and ordinarily it is only by the after fruits of treatment that they shall be determined. A large familiarity with hysterical states increases ones respect for the difficulties of differentiation. Charcot's diagnostic powers of hemianæsthesia, affections of sight, hysterogenic zones, the effect of æsthesiogenic agents upon sensibility and motility, many times can not be readily or promptly applied. Then collateral evidence must guide the physician. Hysteria must have some sort of audience always, and wherever vanity can be detected, or gravely suspected, it will help to determine the nature of attack. The instinct of the physician is also a help, but must not be masked by prejudice.

In the management and moral training of children of hysterical or maniacal tendencies the first step to be gained by physician or care taker is to win their

confidence. The best method to pursue is to show and preserve a frank, quiet, yet persistently friendly, demeanor. In first interviews it is wise with all children to avoid a too direct and impulsive approach. Childish concepts come slowly; conclusions which are being formed with no great promptitude should not be hurried. Overprecipitancy offends, and the result is negative. Very much the same courteous, straightforward methods win a child which prevail with the elder. I have elsewhere emphasized this (I, Univ. Med. Mag., Aug., 1891), and am more than confirmed in my views. It is well to efface as nearly as possible the differences of age or position between the patient and physician. Assume both to be on the same plane, the one simply taking the initiative. It is inscrutable to me how those who talk baby talk, as it is ludicrously miscalled, to children, ever succeed in rendering themselves otherwise than most offensive. There is nothing winning to the feeble intelligence in being treated as an animal. So, thrusting of thumbs in the unprotected abdomen, chucking under the chin, etc., may convulse the infant with reflex laughter or at the grotesque figure of fun cut by the one so acting, but does not inspire confidence or admiration. It is like well-meaning folk who attempt to converse with a foreigner by using broken English. This is no light matter here discussed. Knowledge of the mental processes of the patient one must have, and accurate information only comes through intelligent questioning. I have repeatedly been able to secure the attention and frank answers of a child which my assistants had utterly failed to get, by conveying the impression that I was just such a person as themselves, who asked straightforward questions and fully intended to obtain equally candid replies. And if this be true of the medical man, in rare interviews, how much more needful is it that those who watch and direct the daily progress of the child shall proceed in the same frank, honest fashion ever. Punishment is sometimes needed; sharp corporal punishment, too. Some children of low tone or vicious hysteroidal character are amenable to no other argument. Who shall administer this and when is of the gravest importance, and only harm comes of lack of judgment here. More often gentle domination or kindly encouragement will suffice. A jocose, bantering tone also offends. Begin by questioning the attendant, parent, or nurse, thus allowing the child to take bearings and see you are not an ogre; then proceed to gently draw out the childish thoughts by speaking of perfectly comprehensible subjects first and others indirectly, and finally directly question.

It is often most difficult to convince people who assume the care of poor children, and who are themselves simply well-meaning philanthropists uninstructed in matters of mental development, that the morally or mentally infirm should not be allowed the same measure of privilege and responsibility permitted to others. This overconfidence many times leads to disaster for which the society may be held to account. The members of such societies should inform themselves carefully not only upon the subject of the varying capacities of the individuals entrusted to their charge, but in a general way the proper means of managing those whose mentality is either essentially below par or undeveloped through vicious suppression and perversion. It has been my privilege to be connected with such in an advisory capacity, and it grieved my heart frequently to see glaring mistakes made partly through well-intentioned ignorance and not seldom from vain self-sufficiency.

I could relate instances of moral imbeciles shrewdly manipulating the good ladies for their own selfish ends and becoming irretrievably ruined themselves, for nothing so permanently destroys all remnant of moral sense as the exercise of thieving and lying propensities upon credulous philanthropists. But if this is bad for boys, how much worse to allow girls to grow up through the critical periods of puberty unguided in the essentials of self-respect and purity, and become exposed by their deficiencies in moral restraint to the many temptations offered by too great liberty of speech and action. Several lamentable instances of sexual perversion and social destruction have come my way even after I had clearly pointed out the danger. The component members of these societies too often forget that human children vary

widely, not only in mental capacities, but in degrees of moral stain from ancestry and training. It is too often assumed that, given reasonable opportunities, all children will tend steadily to improve. The children of pauper and criminal classes need most careful watching and unusual training in the fundamental principles of morality. Instead of this they usually get too much liberty and far too much religious teaching. The training in religious thoughts and observances has a tendency to foster an exaggerated emotion, which is in some ways closely allied to sexual excitement. Let the moral instruction always precede the religious. Appended are the notes of three cases—two of no great interest, but one rather unique. Several such of the deepest interest have come under my observation, but I am not permitted to use them freely. One I give in illustration of a vicious tendency, but large general intelligence. A girl born of vigorous parents, but on the mother's side frequently recurring valvular heart disease. The child had a congenital aortic insufficiency so grave as to create astonishment in the minds of physicians who examined her to believe that life should continue. Here was a very great amount of physical and mental activity constantly maintained and unchecked by the parents. Death occurred at about 9 years. This was an instance of great precocity—especially voluble and shrewd in recognizing with unerring certainty the foibles and weaknesses of whomsoever she came in contact, managing those about her with a tact and adroitness to which too high admiration could not be conceded. Large judgment was here exhibited in manipulating others, but her purposes were often unclear. Long before it would have seemed possible for the small creature to learn bad language, for the father was peculiarly free of such habits, the skill and vigor of her profanity would have put a Texas cowboy to the blush. The calm effrontery of her lies were only equaled by the adroitness which was exhibited in covering up her discovered errors and mischievous failures. I have amused myself and indeed gathered much instruction in listening to her caustic critical remarks, when about 5 or 6 years old, on the personal characteristics of those whom she knew. Moreover, she never erred a second time, if once the error was committed, of exceeding her privileges overmuch, especially when swift punishment ensued, but would persistently drive a timid or undecided person, as her own grandmother, to the verge of distraction by a well-planned system of petty annoyance, skillfully pursued.

I could relate many instances of all these and other vagaries, but need not. The child was morally insane, but of such rare wit and intelligence, showing such tact and wisdom at times, as to convey the impression of her being (in sharp antithesis to case I) possessed of the arch fiend, whereas case I might be deemed of angelic descent. Here was an extremely bright, intelligent child—selfish, cunning, untruthful, cruel, and profane—a perfect picture of an almost hopeless mental invalid.

Should such children as this receive the thorough systematic training upon the lines laid down by Fröebel, involving a gradual awakening of the dormant faculties, I am confident great gain might be hoped for. It is my desire yet to see this kindergarten system thoroughly and persistently tried by fully competent teachers on unpromising cases. The limitations as sketched out herein must form a serious barrier to satisfactory results in most instances.

Another case to which I may only briefly allude: One in whom since babyhood a second personality or companion constantly accompanied the child, to whom all matters of doubt were referred. If asked a question this being is consulted by a side speech and the answer then given, or perhaps a difference of view arises and disputes ensue. Again, sometimes the child comes to parents or others and announces that "I have been to see B., and he and I talked over this or that," and arrived at certain conclusions which served as an imperative rule of guidance. There are other evidences of a very exuberant imagination, of a possibly hysterical nature, but no distinct signs of insanity except the delusion out of which the child can not be reasoned. My opinion is that as time advances and educational measures are pursued this will pass away.

Case I.—Helen Foulke, aged 9 years; first child of healthy parents; family history good for physical vigor; on the mother's side a great deal of neurosis with a distinctly religious coloring, coming of a race of Quaker preachers; one uncle, a man of large general intelligence, regarding himself as definitely under divine guidance, even in the matter of catching trains, for which he refuses to consult time-tables, etc., acting perpetually upon this heaven-sent impulse, yet falling into very few catastrophies. H. F. healthy as a baby in all respects. At 18 months had whooping cough, during which asthma developed, and, while very restless always, is very bright and intelligent, but even at that early age showed a marked ability to amuse herself, rather resenting outside interference. At 3 years of age had a sharp attack of pneumonia, which was probably, from the description, bronchitis with asthma; evidently extremely ill; for a time lay unconscious; some cerebral excitement even then, starting up suddenly and crying out loud for no known cause. During this winter there were three attacks similiar to this. On recovery, began to have imaginary playmates, whose names were "Dewey" and "Gee." These were distinct personalities, apparently sexless, with whom she had long systematic conversations, arranged the disposition of her day, and these shared with her in all pleasures, which were largely solitary. Occasionally other imaginary people were introduced into this coterie, of different names. These frequently assumed the individuality of various pieces of furniture, which acted as a sort of negative background for the more active characters, "Dewey" and "Gee." As time wore on these inanimate objects were given human names and regarded as regular companions, with whom long hours of perfectly cheerful play were passed. Her family assumed this to be merely the play of a rather exuberant imagination, because the child could be readily diverted from these to ordinary practical affairs. She was otherwise entirely cheerful; indeed, rather of overexcitable spirits, and in most matters quite rational. The two regular companions and herself held long conversations, and when other children would come in to play with her, the two imaginary ones were brought into the conversation as much as possible; at least, to the extent to which the other children were capable of comprehending. Child playmates were comparatively rare in the isolated home, and therefore this imaginary couple were regarded rather as a boon than otherwise by the parents. The curious fact was observed by neighbors and visitors that Helen would almost never take hold of any object, even those which she had endowed with names and individualities, and with whom she conversed most freely. At 4 years of age she went to a kindergarten, and while there it was almost impossible to make her enter into the regular methods of the school, but on coming home, she would go through the entire performance with the utmost accuracy, showing there was no lack of comprehension. Also, the child failed to recognize orders of the teacher for a long time, simply ignoring them, but gradually got in the habit of submission. At 7 years of age she went to a regular day school and gradually got adjusted to regular discipline. She finally became interested in school work and distinctly overwrought herself, occasionally falling into hysterical conditions. About this time, also (between 7 and 8 years) she had an attack of influenza, which recurred three or four times, accompanied by a good deal of psychical disturbance, and after this fell back into a condition of physical apathy. There no longer appeared the active excitement, the voluble conversations, and such like, but she dreamed dreams both sleeping and waking, the results of which were related, not very frankly, to her mother. For some time she exhibited great slowness in everything, physical and mental, though all this while a moderate degree of intelligence was maintained in practical matters. She gradually grew more talkative and argumentative, discussing most exhaustively the pros and cons of the smallest matter. Gradually religious ideas became prominent; she became sleepless, lost appetite, etc. Then a period of three weeks intervened of very great excitement, coupled with terror. The house was peopled with wild animals, of definite kind and of aggressive fierceness, which kept her in a state of perpetual consternation. She frankly admitted to her mother about this period that she knew she was crazy, declared herself to be the victim of imagination, or worse, and would endow the pictures of living objects on the wall with malignant tendencies, and beg her mother to turn them face down. At 8½ years of age she suffered an attack, rather prolonged, of fever with meningeal symptoms—pain in the back of the neck, constipation, and finally, troublesome diarrhea. At one time a collapse occurred for twenty-four hours, when she was thought to be almost dead. During convalescence there occurred a period of intense excitecmnt for ten days, with active imaginings, and then suddenly intervened the former state of apathy. A period of complete mental deafness occurred for about five months.

This girl came under my observation in June, 1892. There had then occurred an attack of chorea, which in all ordinary respects seemed true chorea. The child seemed rather stupid, filled with sudden fears and certain definite weaknesses which prevented her from walking straight, and also hallucinations of fanciful nature. I found a good deal of irritation about the nasal passages which it seemed necessary

to cure, and, not to prolong the account overmuch, in two or three weeks this was accomplished very nearly. There were no adenoid growths of the pharynx. I directed that she should spend the summer at the seashore, where she improved greatly, the asthmatic attacks disappearing, and the slight naso-pharyngeal catarrh subsiding almost entirely. The mental condition improved very much.

In the autumn, her physical condition being enormously better, and her general intelligence, too, giving great hope of thorough repair, there then intervened a period of extraordinary religious exaltation of a very picturesque kind, and just such as I imagine would convince people of strong religious convictions that this child had been breathed upon directly by the Spirit of God. She had been under the immediate influence of an overreligious servant, who had played upon the impressionable nature of the little girl, had taught her all manner of religious phrases, and done just as much mischief as she could possibly contrive. Thereupon, her pupil proving extremely apt, there transpired a large series of interesting religious phases: One while she would eloquently expound her view of passages of Scripture, her views upon the condition and appearance of heaven, what people should do to enable them to secure residence in the abodes of bliss, etc. There were vouchsafed to her glimpses of heaven, which she described most graphically and charmingly. There finally grew in her the overmastering desire to die and be a blessed angel. As to what she should do and where she should live, how conduct herself, etc., no devotee of the Middle Ages brought up in a nunnery could have more vividly portrayed; indeed, she exhibited a grasp of knowledge of the details of ordinary religious teaching which was out of all proportion to what her previous training would have warranted, giving any casual observer the impression that much of this was actual revelation. Her mother says that this was a feature frequently repeated in various members of her own family, who would fall into ecstatic states, during which astounding revelations were made to them. What might have transpired had not these good people been bound down by the conventionalities of the Society of Friends it is impossible to estimate.

In October, 1892, Helen had an attack of typhoid fever, not over severe. During this time the delirium was of a talkative character, and she readily fell into conversation with whomsoever came near, relating her dreams, intermingled with the constant complaint of the same pain in the back of the head as in her former illness, but with almost no trouble with the digestive functions. After the convalescence from this was safely established, she was brought to me in the city and placed in the hands of two professional nurses of large intelligence, and her condition more closely watched. The improvement in all particulars was steady and admirable. The imaginative tendencies showed themselves occasionally, and were quietly argued away or ignored. The desire to do bizarre and silly things was likewise discouraged, occasional tendencies to soil herself and the bed were promptly nipped in the bud, not too roughly, and a general measure of systematic education in the decencies instituted, which very soon had an excellent effect. From being carefully directed by kind, gentle, tactful personalities, the imagination was clipped, reduced to normal proportions, and a large amount of residual common sense allowed to come to the surface. Undoubtedly much harm had been done unwittingly by the mother in unconsciously encouraging some of these poetic flights, and causeless apprehensions were not judiciously explained away; obedience was not demanded to practical matters at home, overindulgence probably given to vagaries of thought and act, and, in short, parental discipline, never the best in cases such as this, was probably rather worse than usual from a mother who was oversolicitous. July 10, 1893, my last report from this case is most favorable.

Case II.—Bessie A., aged 6 years, came under my care February 11, 1889. Family history good; third child; one dead of cholera infantum. B. was perfectly well in every respect until at 5 years of age had scarlatina very severely; mouth, nose, and eyes seriously affected; vomited constantly for a long time; was ill two months; the vomiting continued until quite recently, at intervals; toward the end of the illness the child was paralyzed, involving the left side. This came slowly on until complete helplessness resulted; eyes were crossed and capacity to swallow almost lost. In two months more began gradually to walk. The power was not especially lessened on either side. Five months after the first attack a convulsion occurred of a tonic character. The body twisted steadily to right, the eyes staring and fixed; the whole person rigid for nearly two hours; the eyes remained fixedly open until the following night; could not speak. A few hours after the beginning of this attack there was a clonic convulsion in which the head moved both ways; pupils at the time were widely dilated. The health slowly mended, until about three months ago began to have attacks of frenzy, complaining of a fear, as from some sudden noise, usually accompanied by the hallucination of seeing a cat. These increased in frequency until a dozen a day occurred; at other times almost none. Now the mind seems distinctly impaired in certain ways; tries to run away from home; on two occasions was lost. The body is miserably ill-nourished; the worm-eaten tongue of mucous

disease, considerable nasal irritation, the right lid eroded, slight ptosis; heart sounds muffled and distant, and slightly irregular pulse. She is very excitable; tries to romp and play with children, but needs to be controlled. I asked my friend, Dr. Randall, to examine the eyes, and he reported as follows: Left eye shows considerable H. As., but no gross lesions in the fundus. The right eye has corneal cicatrix. Right ear shows retracted membrane; the left almost complete destruction of membrane and a trace of left-sided facial paresis.

This child was kept under observation and treatment for over a year, steadily improving in respect to nervous excitability and physical health. The screaming spells steadily lessened. The following January considerable accession of trouble arose from being severely whipped. At that time the heart action was very irregular, and she needed constant systematic treatment of a tonic character, as well as tranquilizing measures. A year after being first seen had a fit, and soon after escaped from the house and disappeared for a day or two. In a year and a half a very severe convulsion occurred confined to the right side, chiefly in the fingers and eyes and mouth. No evidence of palsy followed. The knee jerk was found to be normal on both sides.

May 22, 1891, it was found necessary to place her in the Home for Feeble-minded Children. Is much more rational in many ways, but explosively emotional, and at such times uncontrollable by her mother, and a very great nuisance to the family and neighbors. Under the admirable care which she received at Elwyn, steady improvement took place, until to-day (May 10, 1893) she presents the appearance of an admirably well-grown, splendidly developed girl of 9. I have seldom seen a more perfect physique. The shape of the limbs and quality of the muscles are extraordinary. There appears to be no trouble with any of the organs, except still in the right eye. The intellectuality has not improved to any very great extent; takes some interest in sewing and hand work, such as kindergarten studies; can sing correctly; has a vile temper if aroused, which occurred rarely of late, and is then said to fight like a maniac; at times is rather destructive, but on the whole is a very good girl, obedient to teachers, and talks affectionately of them. She, curiously enough, has a very kindly regard for myself, probably because I was the only one, until she went to the home, who dominated her sharply, and even now constantly talks about me, and promises her companions that I shall be brought to see them. To-day the only peculiarities in her nervous state are slightly excessive knee jerks in both legs and a slight clonus in each of two or three beats.

Case III.—A. B. Female, aged 10 years. No insanity in the family. Parents living, one brother. Previous health of patient good, but always nervous and with weak digestion. One year ago and again six months later had a convulsion following an indiscretion in diet. These convulsions passed off without leaving any apparent permanent injury. About three months ago she had a series of convulsions lasting five hours, and accompanied by fever followed by a trance-like state lasting for two days. Since then she has continued in her present state. Expression vacant, indifferent, demented. No sign of affection. Habits, filthy and shameless. Irritable, but never weeps. Rarely quiet. Lies in bed, rolling rythmically from side to side. This movement is apparently automatic. At other times she will pace the floor like a caged beast. Makes no attempt to speak, but hums a monotonous tune. Does not like to be touched. Hearing is good. Appetite is fair. Puts any object given her in the mouth. There are no palsies. The reflexes are normal. Abdominal and thoracic organs normal. Urine normal. Pupils at times dilated and react to light and accommodation. There is marked pallor and emaciation. After a year her physical condition had much improved. Mentally she is in a condition of dementia.

ARTIFICIAL ALIMENTATION OF CHILDREN IN MEXICO.

By Dr. J. R. ICAZA.

GENTLEMEN: This is a subject that was proposed to me by the honorable Dr. Keating, worthy president of this Section of the Diseases of Children, and of which, counting upon your good will, I am going to briefly treat. According to him, it is not my part to busy myself with the different branches that may be allied in a general way to the alimentation of children, nor is it even my duty to make an analytic study of the different methods, more or less worthy of recommendation, that are employed to raise them, when, by some circumstance, they are deprived of their natural food. My mission is reduced, I believe, to telling what is done in my country in such cases. Nevertheless, although it may be a few words, I will say

something of the course pursued by the Mexican physicians in directing the alimentation of children in the first epoch of their lives; that is, from birth until the first dentition is over.

In Mexico, gentlemen, it is the general rule that the mothers nurse their children, and it is the truth that we physicians never have to tell Mexican women of the obligation they have of suckling their offspring. There they are dedicated completely, and perhaps to an exaggerated degree, to the domestic duties, and the privations and annoyances of raising children to full age matter little to them and prove a pleasing task. But when the children are left orphans, or when the mothers are unable to nourish them because of lack of health, because they have not sufficient milk or because the milk is bad, then we recommend a wet nurse, taking precautions, you understand, before trusting the child to her care, to examine her thoroughly to see if she is healthy and if her milk is abundant and of good quality. It is worthy of remark that the wet nurses always live in the house and are under the direct vigilance of the family. But if the poverty of the family or other cause prevented the employment of a wet nurse, there is no other remedy than to resort to artificial food; but we never advise this course, so troublesome and full of difficulties and obstacles, to be followed, except when we see ourselves forced to do so by exceptional circumstances. I express myself so, because the direct lactation by females of animals is very rarely done. However, in some cases goats are used, because, as is well known, they are better adapted to the purpose, as much on account of the form of their mammæ and the abundance and quality of their milk, as that they easily become accustomed to take care of the children.

We now arrive at the first question: What do we do in my country to artificially nourish children? Generally milk of the cow, goat, or ass is given them. That of the cow is the most used because it is cheaper and more easily obtained. It is scarcely ever given in its crude state. It is customary to use it skimmed and boiled mixed with an infusion of yerba buena, orange leaves, tea, or some other aromatic plant, or boiled water in order not to change the taste and not to diminish the original nutriment. This mixture is made in various proportions; for children under six months, two parts of water or of the infusion are mixed with one part of milk; from the sixth to the ninth month, equal parts of milk and water; from the ninth to the twelfth month, two parts of milk and one of water; after one year, three-fourths milk and one-fourth of water, and after fifteen months pure milk is given. In administering it the bottle is often used. We have many models on the market, but the most accepted for its simplicity and for the ease in cleaning it, a most essential condition in order that the milk may not be altered in its constitution, consists of an ordinary bottle of 300 grams, approximately, the mouth of which is made of gutta percha. In the first six months a half bottle is given every three hours and after that age a full bottle in the same intervals. At times it happens that children refuse cow's milk or digest it badly and it is then given them mixed or boiled with flour, corn, wheat, or rice and it is often greatly improved by the change.

Ass's milk and goat's milk are also employed, especially the first, whose composition, as is well known, resembles that of human milk. It is more difficult to obtain and costs more. Families that are able to enjoy some conveniencies have the ass in their own yards so as to be able to order milk for the child when needed, which is then taken warm and without any adulteration. I could cite many cases in which ass's milk has given positive aid in raising children. A chemical analysis shows that it is more easily digested than that of any other animal.

Some families give their children artificial preparations, such as Nestle's Lactated Food, which is composed, principally of toasted bread dust, wheat flour, and milk dried in a vacuum; Hagner's Food, Liebig's Extract, or other similar mixtures. The poor often use *atole*, a drink that consists of a paste made of ground corn which is diluted with water and milk and afterwards boiled. This is a food less wholesome and nutritive than milk but easily digested.

The truth is, it is necessary to vary the food for it happens that children, like adults, have different individualities and what is acceptable to some proves nauseous to others.

I have already indicated that in Mexico it is vary rare that a child is given milk or any of the preparations I have mentioned. These preparations are used more especially for mothers and wet nurses, when the milk becomes scarce, and for motherless children—in a word, for variety's sake. However, among the poorer classes, the children are often denied the breast and are given all kinds of food. If artificial feeding, conducted with great care, is always perilous, it is much more so if not done in an intelligent manner. As proof of this assertion I will say that we see every day among poor families more or less grave disturbances of the digestive organs in children prematurely weaned which are quickly cured by a return to the breast; and we see also that the children of poor nurses, badly nourished and improperly fed, nearly always perish.

THE GENERAL PRINCIPLES UNDERLYING ALL METHODS OF INFANT FEEDING.

By T. M. ROTCH, M. D.

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Just as the highest aim of medical art should be directed to the province of preventive medicine, so the highest and most noble branch of preventive medicine should consist in the study of the best means and the most practical methods for starting young human beings on their life race; for preserving them from the perils which surround the early hours of existence; for giving them strength and vigor to resist the attacks which, greater and more dangerous in inverse proportion to their age, must inevitably be made upon their vitality. The preventive medicine of early life is preëminently the intelligent management of the nutriment which enables young human beings to breathe and grow and live. In fact, it is a proper or an improper nutriment which makes or mars the perfection of the coming race. Infant feeding, then, is the subject of all others which should interest and incite to research all who are working in the preventive medicine of early life. The subject is a great one and is worthy of the attention of the greatest minds of the age; worthy for the discussion of the leaders in medical thought of our Western Continent. The responsibility of introducing such a serious question before such an assemblage of advanced medical thought is a grave one. It should be taken up carefully—it must be dealt with broadly. We must acknowledge for the present, and in fact it is true, that in the status of infant feeding as it has existed up to the last few years, the average human breast-fed infant is more likely to live, the other factors of the life problem being equal, than the infant which is fed by any other method. But we must remember that the latest scientific work on this subject shows very clearly that it is not breast milk as a whole which is preëminently good, but that there are definite known reasons inherent in the different elements of the breast milk which make it the best known food. It is our province as scientific workers in this most important branch of practical medicine to year by year elucidate and make use of these elements, once covered by a somewhat mysterious veil, but now rapidly being laid bare by the search light of patient and laborious investigation. A great advance has been made in our knowledge as to what we are to copy from human breast milk and what we must achieve in preparing a substitute.

The very essence of this practical information which we have gradually acquired lies in the discovery that there is no one perfect nutriment for young human beings as a whole, but that it is the changes in the various elements of the breast milk which satisfy the demands of the individual, and thus in time suits the many to such

a degree that this protean food has erroneously come to be looked upon as one especial, unchanging nutriment. To thoroughly understand and successfully solve the feeding problem of the early months of life, a knowledge of the changes which take place in the mammary gland from many causes must be clearly kept in view. Again, the methods of modifying the milk in the human mammary gland, however limited in their scope they may be, should be practically investigated and carefully adapted to the individual according to its age and size and general physical condition. The mammary gland in its perfected state, uninfluenced by disease or nervous disturbance or by the improper living of its owner, is a beautifully adapted piece of mechanism constructed for the elaboration and secretion of an animal food. When in equilibrium it represents the highest type of a living machine adapted for a special purpose, both mechanically, chemically, physiologically, and economically. When for any cause this sensitive machinery is thrown out of equilibrium its product is at once changed, sometimes but slightly, but again to such an extent that the most disastrous consequences may follow when it is imbibed by the consumer. To state then, concisely, what I have already referred to, we should, in studying the form of nutriment which shall be suitable for the early months of life, manifestly be guided by what nature has taught us throughout many ages.

The researches of science are, indeed, especially in the subject of infant feeding, wisely directed to learning to read the truths which nature presents to us. Great progress has been made in reading these truths; what we are at present endeavoring to do is to copy them. The constituents of the nutriment which nature has provided for the offspring of all mammals is essentially animal and never vegetable. Human beings, therefore, in the first twelve months of life are carnivora. It is therefore evident that an animal food entirely and always free from any vegetable constituents has been proved to be the nutriment on which the greatest number of human beings live and the least number die. Where good breast milk, or rather one that is fairly adapted to the individual infant, can not be obtained, or, if obtained, can not be regulated by modification, it is desirable to combine the elements which good breast milks represent. For perfecting this, what best may be called substitute feeding, we must have a material which, while as closely as possible approaching the analyses of good breast milks, is also easily accessible. There is no mammal whose milk production corresponds sufficiently to human milk to render a direct substitution safe or wise. If, therefore, milk is used, the problem demands for its solution a modified milk. The mammal whose product representing a carnivorous food has been proved from the earliest ages to best satisfy this demand is the cow. Certain breeds of cows are better adapted than others to produce milk which can be used for copying human milks. For the use of this continent these breeds are the Durham, Ayrshire, Holstein-Friesien, American grades, and common natives. The infant at the breast receives for its nutriment a fluid which is fresh, sterile, neutral or faintly alkaline in reaction, which has a temperature of 98° to 100° F., and which is furnished in an amount proportionate to its age and size. It is this fluid which we should copy in every possible detail when we undertake to prepare a substitute food. We should also consider as foreign matter to be rigidly avoided, any element which we know is not to be found in the fluid which we are copying. Thus, and thus only, can we finally arrive at the proper solution of this intricate feeding problem. It would seem hardly necessary to suggest that the proper authority for establishing rules for substitute feeding should emanate from the medical profession and not from nonmedical capitalists. Yet, when we study the history of substitute feeding as it is represented all over the world, the part which the family physician plays in comparison with the numberless patent and proprietary foods administered by the nurses is a humiliating one and one which should no longer be tolerated. I would plead in the name of common humanity, as well as in that of the intelligence and scientific reputation of our profession, that this representative body of American physicians should in its endeavor to advance

the general subject of infant feeding record itself as opposed to the use of patent or proprietary foods of every description. If we are abreast of the times, if we will but recognize and do justice to the work which has lately emanated from our own profession, we surely will not hesitate to boldly relegate to oblivion the statements of the food proprietors, which on box and can, on bottle and on printed circular, attempt to stem the slow but inevitably progressing wave of scientific investigation. It may be well to bear in mind that the attempts which in the past have been made to manufacture cheap foods have been markedly failures. We must first, regardless of expense, learn to produce by modification a perfected substitute food before we should endanger the success of our undertaking by allowing the mercantile side of the question to cripple us in the use of costly methods which, however, we know to be the best. We should, in fact, remember that the nutriment which we are endeavoring to copy, far from being a cheap product, is, on the contrary, a very expensive one. It is the knowledge of how to determine the best combinations of certain elements and the best methods of accomplishing these combinations which has in the last year or two especially claimed our attention and in which we have met with signal success.

There is no doubt but what one of the most important questions connected with the preparation of a substitute food is the proper control of the primal milk supply. What that control shall be and how it shall absolutely be kept in the hands of those who by education and unselfish interest are most fitted to use their power wisely is a matter worthy of your deepest thought. The state control, as represented in Denmark, is indeed a brilliant example of what can be accomplished in this direction. Whether a similar method would prove to be the best for us to adopt has not as yet by any means been proven. The political clouds which continually obscure the highest scientific aspirations on this continent make it probable that for the present, at least, the primal milk supply can best be perfected by individual enterprise and enthusiasm.

Finally, I would call your attention and consideration to the great capacity of different infantile digestions for assimilating a variety of proportions of the same nutritive elements, and hence when introducing new methods for preparing a substitute food the necessity for providing for many prescription possibilities. The latest researches on human breast milk show that the albumin of the milk is not merely an exudation from the lymph vessels supplying the mammary gland, but that it is actually modified in the breast. We thus see that the mammary gland, besides being an elaborator and a storehouse for infant nutriment, is also a modifier. Following, therefore, nature again closely, we learn that the precise modification of an absolutely pure and fresh primal milk supply is the vital principle which should at present underlie our efforts to perfect substitute feeding, and I trust that those who will to-day take part in the discussion of this very important subject will especially enlighten us on two matters of extreme interest. First, what is the best method of obtaining a stable and perfect primal milk supply? Second, when this supply is obtained how shall it best be modified?

STUDIES IN INFANT FEEDING.

By HENRY DWIGHT CHAPIN, M. A., M. D.,

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There are certain requisites for an infant's food before it can be recommended for general use. Thus, it must be readily procurable under the common and ordinary conditions of life; it must be digestible, nourishing, and fairly cheap. The mixing or preparation of such a food must not be too complicated. The conditions here mentioned can only be met by employing cow's milk, more or less diluted or altered, according to the necessities of the case. The following paper contains no new prin-

ciples, but is rather a record of experience in the simplest manipulation of cow's milk to make it most acceptable to the infant's stomach and digestion. The clinical experience has been principally derived from the babies' wards of the New York Post-graduate Hospital, where the infants are subjected to close scrutiny and constant weighing during periods varying from several days to as many weeks and sometimes even longer. Those who have had a large dispensary and hospital experience in artificial infant feeding among the poor can not have failed to notice the frequent tendency to atrophy. This is often so extreme as to cause death. Even in cases not so marked there is almost universally present a condition of underweight. Many unfavorable hygienic conditions favor this deplorable result, but the principal cause is the nature and quality of the food that is administered. This grave tendency toward atrophy should constantly be borne in mind in all studies bearing on artificial infant feeding.

The milk as ordinarily delivered on a given morning in New York, and doubtless in other large cities, consists of a mixture resulting from the milkings of the previous morning and the night preceding, thus being from 24 to 36 hours old. If the milk dealer knows his farmers he can sometimes induce them to put the 24 hours' milk in a can by itself, which is a gain as regards infant feeding. What is urgently needed is more scrupulous cleanliness in the handling of the cows and milk upon the farm, and quicker and more frequent methods of transportation of the milk to town in order to represent a real gain in the feeding of infants. It need hardly be mentioned that the average milk from a herd of cows is better and safer than the traditional one cow's milk. As soon as the milk is received in the early morning it is put in a tin pail or wide-mouth vessel that is covered and allowed to stand in a cool place for 3 hours. The top half only of this milk is to be administered to the infant, as advised by Dr. Meigs. This top portion is best separated by being carefully dipped off by a cup or ladle. If decanted both layers of the milk will become mixed by the lower part rising when the vessel is tipped. At the babies' wards a long glass cylinder is employed, which is graduated and furnished with a stopcock at the bottom. After standing the required time a distinct difference is noted in the two portions of the milk, which are easily separated by drawing off the lower half and reserving the remainder for the infant's use. In order to learn exactly what difference the simple process of standing would make, the two parts of the milk were analyzed, with the following results: One gallon was drawn from the bottom of the cylinder, well mixed, and a sample taken which showed:

	Fat.	Total solids.
	Per cent.	*Per cent.*
1	3	12.29
2	3	12.44
3	3.1	.....
Mean	3.03	12.36
		3.03
Solids not fat	.....	9.33

The upper portion of the milk, 1 gallon, was well mixed and a sample showed:

	Fat.	Total solids.
	Per cent.	*Per cent.*
1	4.9	14.01
2	4.8	14.02
3	5	.....
Mean	4.9	14.015
		4.9
Solids not fat	.....	9.115

This analysis shows that practically the only change on standing is a rise of fat. This, of course, slightly raises the percentage of other solids in the lower portion, since the abstraction of any constituent from a mixture raises the percentage of all the remaining constituents. The upper portion contains, roughly, 5 parts of fat for every 3 parts contained in the lower portion. The minimum of fat allowed for genuine milk is 3 per cent. The increased amount of fat thus procured, in the part of the milk to be used, represents a real gain in feeding the infant. The newer analyses of milk do not confirm the older view that cow's milk contains more fat than human milk, but rather the reverse. Thus Prof. Leeds found, upon analyses of 43 samples of woman's milk, an average of 4.013 per cent of fat, while upon analyses of 11 samples of whole market milk the average percentage of fat was only 3.75 per cent. König finds the average of fat in woman's milk to be 3.90 per cent, and in cow's milk 3.66 per cent. Prof. Rotch places the average of fat in both cow's and woman's milk at 4 per cent. As cow's milk has to be more or less diluted before being administered to the infant, the necessity of starting with a preparation that is rich in fat will be apparent. The next step to be taken is to see that all fermentation in the milk is stopped.

Cow's milk, as ordinarily procured, must be treated for its biological as well as its chemical properties. The well-known process of sterilization aims to fulfill this object. Partial sterilization, or pasteurization, to the point of killing the germs only, is necessary and desirable. The high and continuous temperature required to destroy spores produces various unfavorable changes in the milk. Practically, all that is required is to submit the milk to sufficient heat to destroy the bacillus of lactic-acid fermentation which causes the souring of milk. This bacillus has been described as of small oval form, occurring singly and in pairs. It is easy, by prolonged and repeated applications of high temperature, to keep milk indefinitely from souring. By reheating once or twice, it can be kept for months without any sign of acid fermentation. Such milk, however, is by no means fit for administration to the infant, as the fat collects in masses and changes have taken place in the albuminoids. The casein is altered, the milk remaining more or less liquid in the stomach, as the action of the stomach acids and of the lactic ferment on the casein of sterilized milk is incomplete. Analyses of excrement show more nitrogen and more fatty acids after feeding with sterilized milk than with raw milk. Not only is the digestibility of the milk diminished by long heating, but the necessity for it indicates so much bacterial impurity that their excreta, which can not be rendered harmless by heat, may cause poisoning. It has been found that milk well sterilized will, after a certain interval of time, undergo a species of decomposition with an alkaline reaction. Dr. Koplik states that the alkaline fermentation has not been investigated to such an extent that we can with certainty pass upon the deleterious or non-deleterious effects upon infants of the products of this decomposition. It is enough to know that it takes place, and certain alkaloidal elements are very slowly but surely produced. Accordingly, this writer condemns the storage of sterilized milk and its subsequent use after prolonged periods, and I concur with this opinion Simply sufficient heat must be applied to the milk to keep it sweet until the next supply can be procured. An ordinary double boiler, such as is found in every kitchen, will meet all the requirements of average heating. The Arnold steam cooker may prove more convenient, and Freeman's pasteurizer is handy and efficient. As a rule, 15 minutes' heating is sufficient with the bottles well plugged with cotton. The addition of a 1 per cent solution of peroxide of hydrogen is a safe preservative of milk for some hours, when heating is undesirable or not convenient. If more scrupulous care were exercised at the source of the milk supply, and the impurities completely separated by the centrifugal process, in the great majority of cases no means at all for preservation need be employed, and an advance in this direction is urgently needed.

We still have facing us the old and difficult problem of how to act best upon the

tough, leathery curds of cow's milk as to make them most acceptable to an infant's weak digestion. Not only are the albuminoids much greater in amount in cow's milk, but the portion coagulable by acids is greater than the non-coagulable part, while in woman's milk the non-coagulable part much exceeds the coagulable portion. Hence the dilution of cow's milk, while reducing the albuminoids to a proper percentage, does not necessarily render the clot sufficiently soft to be readily digested by the infant. The question whether the size of the curd stands in any relation to the substance used as the diluent has been disputed. It has been taught that by adding gruels of the cereal grains to the milk the clot is mechanically attenuated. Dr. Rotch states, on the contrary, that practically the size of the curd depends simply on the dilution of the albuminoids and not upon the particular menstruum used. Clinical results, however, point plainly to the utility of diluting with barley water, except in very young infants, and I believe the beneficial effects are, to a certain extent, due to a lessening of the compact character of the clot. In order to test this, the following experiment was made by Dr. Eiloart: Equal parts of milk and barley water were taken, and 0.1 gram of hydrochloric acid was added to 100 c. c. of the mixture. This strength was employed, as in gastric juice there is 0.2 gram of hydrochloric acid to 100 c. c. of fluid, which, on dilution by the contents of the stomach, is weakened somewhat, so that 0.1 gram is a fair estimate for the experiment. Some albumins require 0.2 per cent hydrochloric acid added to pepsin in artificial digestion to obtain the best results, but casein and vegetable albumin are digested best by 0.1 per cent of hydrochloric acid.* This experiment showed the casein formed in finely divided clots. Next, equal parts of plain water and cow's milk were taken and 0.1 gram hydrochloric acid added to 100 c. c. of the mixture. This showed larger clots than before. A number of repetitions gave similar results, using various coagulating agents when plain water and thin gruels were used as comparative diluents. When rennet alone was used as the coagulating agent, the results were so different from those obtained when hydrochloric acid was used with the rennet that recourse was had to the stomach itself, with results given in the accompanying paper by Dr. Eiloart. The disadvantage in the employment of wheat or barley flour consists in the large proportion of starch contained in these grains, which may be great in very young infants. This starch may be rendered more soluble and easy of assimilation by heat or diastasic action. In many cases the effect of prolonged heating upon barley and wheat flour seems to have a beneficial effect, particularly when there is a tendency to diarrhœa. The good results of the old flour ball, made by prolonged boiling of the wheat flour in a bag, have long been recognized. But the heat so applied does not produce its beneficial effect by chemically changing the starch, but probably from some physical alteration which renders it more effective as a diluent.

The effect of dry heat upon starch is to produce changes into soluble starch, retrodextrin, achroödextrin, and finally a small percentage of dextrose and maltodextrin.† The higher dextrins are more soluble. Starch does not begin to dextrinate until 250° F. is reached, and this temperature should be maintained for several days if there is any quantity to be changed. At between 350° F. and 400° F. dextrination may take place in a few hours. It is evident that such a high temperature can not be maintained by any domestic process. If put into an oven the flour will soon be scorched or burned. An interesting experiment was made by Dr. Eiloart upon barley flour that had been heated for a week in an ordinary double boiler. The water in the under vessel was allowed to boil for a week, with the exception of a few hours at night, the dry flour in the upper vessel being thus exposed to as high a constant temperature as possible under the circumstances. An analysis of the unheated meal taken from the same barrel yielded two-thirds more sugar and one-quarter more dextrin than the heated meal. The cause of this is that the diastase, whose function it is to convert starch into sugar and dextrin, is partially paralyzed by heat, the fer-

* Hammarsten. Lehrbuch der Physiologischen Chemie, 1891.

† Stohmann and Kerl. Muspratt's Chemie, Bd. 11, Braunschweig, 1889

ment undergoing this change at about 175° F. This method of acting upon the starch was accordingly abandoned, and the necessary change effected easily and quickly by means of diastase. Starch treated with diastase is split up quickly into maltose and dextrin, and the longer the action is continued the higher dextrin will be formed, such as achroödextrin and maltodextrin. After a number of experiments and analyses, Dr. Eiloart devised a receipt, for which I am indebted to him, and which has been used at the babies' wards, consisting of a mixture of barley or wheat flour treated with diastase,* the temperature of digestion being regulated by the addition of hot and cold water in proper proportion. The complete description of the process will be found in the accompanying paper.

A FOOD FOR INFANTS, WITH EXPERIMENTS, CHEMICAL AND PHYSIOLOGICAL.

By ARNOLD EILOART, PH. D.,

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The experiments here described were intended to throw light upon two problems. The first was the formation from cow's milk of a curd resembling in fineness that from woman's milk. The importance of this seems evident,† and Uffelmann‡ has shown that in artificial digestion the proportion of peptone formed was greatest when the curd was loosest. He recommends mixing cow's milk with three-fourths its volume of 0.2 per cent hydrochloric acid in order to make the casein like that of human milk. Munk,§ having tried Scherff's process of sterilization (heating to 100° C. under 3 atmospheres pressure), states that milk so treated clots in the stomach itself in flocks like woman's milk, not in compact masses like ordinary cow's milk. It seems unlikely, however, that these methods will come into general use, and the following work has been confined to testing diluents which are everywhere available. The result of a preliminary investigation was surprising, for it appeared that the fineness of the curd depended more on the curdling agent than on the diluent mixed with the milk. Thus, with rennet, mixture A curdled finer than mixture B, while with hydrochloric acid, 1 per cent, mixture B curdled finer than mixture A.‖ Hence the test-tube experiments, which have constantly been quoted to show the effect of various diluents, must be abandoned and the infant's stomach itself must be consulted to decide what mixture will curdle finest in that stomach. Accordingly, the mixtures to be tested were administered to infants, and after a short interval withdrawn by means of the stomach pump. I am indebted to Dr. Chapin for the opportunity of carrying out these tests in the babies' wards of this hospital.

In the following table I have used figures to indicate degrees of fineness of clot, calling the finest curd 1:

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* Maltine was the preparation here yielding the diastase.

† Ellenberger and Hofmeister, however, object to the fine curd of sterilized milk, because it may pass too quickly through the system and thus escape complete digestion (Molkerei Zeitung, 1892, 6).

‡ Pflüger's Archiv, 29, 399.

§ Deutsche Med. Woch., 1881, No. 36.

‖ Mixture A was milk and water, āā; mixture B was milk and barley water, āā. With a mixture of hydrochloric acid and rennet the result was the same as with the acid alone. In every case the volume curdled was 100 c. c.; very small quantities fail to show the differences in the curd.

TABLE I.—*Showing fineness of clot and acidity of stomach contents after feeding with milk and various diluents.*

[Fresh milk was used except where sterilized is mentioned. Throughout this work the regularly prescribed malt preparations were used as the source of the diastase. + means a small dose, + + a full dose.]

No.	Date.	Name.	Age (months).	Health.	Taken.						Time before pumping (minutes).	Quantity pumped.	Fineness of clot.	Acidity calculated as HCl.	
					Milk.	Water.	Barley water.	Wheat gruel.	Wheat, recipe II.	Diastase.				Total.	Quantity pumped.
												c. c.		Per ct.	Per cent.
1	Feb. 15	George Carlson	8	Good (adenitis)	50	50					1	117	3	.050	.0427
2	...do	Stella Morris	2	Bad (syphilis)	50	50					1	12	3	.0109	.09
3	...do	Annie Riker	6	Medium (inanition)	50		50				1	109	2	.047	.0438
4	Mar. 4	Ed. Scores	1½	Good (eczema)	100					+	1	15	1		
5	...do	Stella Morris	2¾	Fair (syphilis)	30		30				1	27	2		
6	Apr. 25	Ab. Sayres	2½	Good (cured)	*100	100				+	10	124	3	.137	.0905
7	...do	Henry Hasbrook	6¾	...do	*100	100					10	140	1	.065	.0467
8	Apr. 29	Ab. Sayres			*100	100					10	108	3	.093	.086
9	...do	Henry Hasbrook			*100	100				+	10	97	2	.061	.063
10	May 3	Ab. Sayres			70	70				+ +	20	28	2	.017	.060
11	...do	Walter Grandman	6	Good (cured)	100	100					15	9.5	2	.0087	.092
12	May 8	Ab. Sayres			51	51					15	86	3	.063	.073
13	...do	Walter Grandman			60	60				+ +	15	44	3	.0289	.066
14	...do	Frances Collins	1½	Marasmus	35	35				+ +	20	65	3	.052	.083
15	...do	Louisa Bechl	8	Good (gastro enteritis)	54	54					20	59	3	.031	.053
16	May 19	Joseph Kelo	3	Good (phimosis)	71				71		2	70.5	3	.046	.066
17	...do	Joseph Lobe	2½	Fair (erythema)	65		65				2	65	2	.031	.047
18	...do	Frances McIntyre	3		45		45				3	67	2	.046	.069
19	May 22	...do			85				85		2	60	1		
20	...do	Joseph Lobe			100				100		1	135	2		
21	...do	Mary Bailey	3	Marasmus	75			75			14	59	2		
22	...do	Joseph Kelo			75			75			4	7	3		

*Sterilized.

The figure 4, indicating the very coarse clot sometimes obtained with hydrochloric acid (0.1 per cent), is absent from the record of stomach clots, although the percentage of acid in the stomach, calculated as hydrochloric, sometimes rises almost to 0.1 per cent. The chief conclusion to be drawn from the stomach experiments is that the coarseness of curd increases with the percentage of acid. Thus the finest curd (called 1), which was only once obtained, occurred when the acidity was 0.0467 per cent; the curd next in fineness occurred in 6 cases in which the mean acidity was 0.062 per cent; whereas for curd 3 (rather coarse) the acidity averaged 0.072 per cent (mean of 9 cases).

So far we have left out of account the diluent used. If we arrange the results so as to show the number of times a given diluent produced a curd of the second or third degree of fineness, we find that water gave clot 2 once, clot 3 four times; barley water gave clot 2 three times; diastase, with or without cereals, gave clot 2 twice, clot 3 four times. So far the results proclaim barley water to produce the finest, and water the coarsest curd. But when we take into account the acidity in the different cases, we find it to average in the three barley-water experiments only 0.053 per cent, while in the four water experiments it is 0.077, and in the case of the diastase preparations, which yielded curds almost as coarse as the water mixtures, the acidity is nearly as high, viz, 0.071 (average of the 6 cases). The good results apparently due to the barley water may, therefore, be due in reality to a low percentage of acid. On the other hand, further experiments may show that barley water itself causes the low percentage of acid.

The influence of the concentration of the curdling agent is well seen in the following experiment made with an adult: A mixture of 500 c. c. milk with 500 c. c. water at blood heat was taken. Two minutes afterward 360 c. c. were pumped out from the stomach; 6 minutes later 400 c. c. were removed; 8 minutes later the rest was removed. The first portion was curdled so fine that close examination was needed to see that it was not homogeneous. The second portion was fine, but coarser than before. The third portion consisted of yellow liquid with some quite coarse clots; the gastric juice was no longer diluted by excess of milk.

EXPERIMENTS WITH CEREALS.

Whatever be the part played by barley water in the stomach, it has made good a place in infant feeding, which indicates that benefit is derived from its use. But it seems probable that any such benefit is largely neutralized by the great proportion of starch which all cereals contain and which the infant economy is ill adapted to digest. It is true that infants' food may be bought in which the starch has been dextrinized by heat; but these are expensive. The object was then to devise a household process for preparing at a minimum cost, and with materials everywhere available, a digestible food containing with the albuminoid constituents of the grain, carbohydrates in a soluble form and but little of the insoluble starch. At the same time excess of sugar was to be avoided. This necessitated the conversion of the starch into dextrin, or into dextrin with a moderate proportion of maltose. Attempts to dextrinize the starch by heat showed that this method is not adapted for household use. Barley cakes baked many hours yielded only 23.3 per cent of soluble matter. Rusks ("Zwieback") as bought were further baked, but only 16 per cent could be made soluble. To facilitate the dextrinization by providing an acid, barley cakes were made with buttermilk and well baked, but the soluble matter was then only 20.07 per cent. Rusks moistened with buttermilk and baked at 120° C. yielded 18.88 per cent of soluble matter. These results necessitated a resort to diastase as the converting agent. O'Sullivan has shown that maltose and dextrin are the only products of the action of diastase on starch, and that the proportion of maltose to dextrin depends on the temperature. This proportion may be kept down to about 18 per cent by employing a temperature just below that which destroys the diastase and by stopping the action before the diastase converts the dextrin first

formed into maltose. To adjust the temperature, hot and cold water were mixed in varying proportions. The temperature of the hot water was the highest which can be attained in the inner vessel of an ordinary double boiler of tin or enameled iron when the water in the outer vessel is kept boiling; this temperature does not vary much with the size of the boiler and is about 91° C. The diastase was allowed to act on gruels made with starch, with wheat flour, with barley meal, and with oatmeal. The line of action, the quantity of water, and the temperature (proportion of hot to cold water) were varied, and more than twenty analyses were made to determine the proportion of soluble matter and maltose formed in each case. As the result of these experiments a most simple process was arrived at, by which in any kitchen a cereal food may be made containing three-fourths of the solid matter in a soluble form and having more or less sugar (maltose) as desired.

For a food containing about one-third of the solid matter in the form of maltose, the following recipe may be used:

Recipe I.—Materials: Wheat flour or barley meal, 2 ounces (2 tablespoonfuls heaped as high as possible); water, 56 ounces (a quart and three-fourths); extract of malt, half a teaspoonful or a small teaspoonful.

Process: With 30 ounces (a scant quart) of the water make the flour into a gruel, boiling 10 minutes in a double boiler. Take out the inner vessel and add the rest of the water cold, the malt extract being dissolved in the last few ounces added. Let it stand 15 minutes. Put back the inner vessel and heat again in the double boiler 15 minutes. Strain through a coffee strainer of wire gauze.

If for any reason it is desirable, and in cases of diarrhœa, to give a smaller proportion of maltose, the following recipe is used, and we get a food containing only one-fourth of the solid matter in the form of maltose:

Recipe II.—Materials as in Recipe I. Proceed as before, but reserve only 1 pint of the water for adding cold. After adding the cold water with the malt extract dissolved in the last few ounces of it, let it stand only 3 minutes instead of 15 minutes. Then heat 10 minutes in a double boiler and strain. To make the gruel well and quickly, beat the flour with very little water. A little beating with little water is better than much beating with much water. Beat smooth, therefore, while the paste is still almost a dough; then add cold water to make a thin paste, and to this add the rest of the first part of the water boiling hot, with stirring. If these directions are followed, very few lumps will remain on the strainer; in fact, only about 5 per cent of the meal need be lost in this way. The water in the outer vessel of the double boiler must be kept boiling throughout. Whichever recipe is followed, the food should be taken mixed with milk.

Digestion tests: *Cæteris paribus*, the more of a food is dissolved in the stomach, the more digestible is that food said to be. Therefore if we find in the stomach contents, after giving milk with malted food, a larger proportion of soluble matter than when milk is given with unmalted food (due allowance being made for the larger proportion of soluble matter in the malted food itself), then we may say that the malted mixture is the more digestible of the two. In order to test this, experiments were made with three infants and the following results were obtained:

Ratio of soluble to total matter in stomach contents.

Subject.	With malted food.	With unmalted
1	0.65	0.58
2	.74	.61
3	.58	.64

The difference is appreciable (later results indicate that this was due to the short time allowed for digestion, which never exceeded a few minutes in the above cases). A comparison was next made between the two foods without admixture of milk.

The process now followed was this: The stomach of a healthy man was washed clean with lukewarm water—i. e., the washing was continued till the water from the stomach ran perfectly clear. Then a definite measure of gruel containing a known weight of solid food was drunk in five equal draughts with an interval of a minute between each draught. After a certain time the stomach was again completely washed; the washings were made to a given volume. The total solid matter and the dissolved matter were determined; the difference gives the matter undissolved. Experiments were made with 3 men, all free from any disorder of the stomach. The food prepared with diastase was given one day and the plain gruel the next. Although the amount of either food disappearing in a given time varied considerably, the results were sufficiently concordant to decide the questionat issue.

TABLE II.—*Showing proportion of food found in stomach after various periods of digestion.*

[A (—) under "diastase" indicates that none was given. A (+) indicates that the diastasic extract was used in the proportion given in the recipe.]

Number.	Date.	Food taken.			Found in stomach after time named.				Time (minutes).	Remarks.
		Volume.	Weight.	Diastase.	Total solids.	Undissolved solids.	Food taken.			
							Total solids.	Undissolved solids.		
		c. c.	*grams.*				*Per cent.*	*Per cent.*		
1	July 8	500	11.76	—	5.48	.62	46.6	5.3	40	Recipe No. II. Subject No. 1.
2	July 11	1,000	38.6	+	14.35	1.81	37	4.7	40	
3	July 12	1,000	30.24	—	13.2	2.39	43.7	7.4	40	
4	July 13	1,000	30.00	+	8.96	.67	29.8	2.2	40	
5	July 15	1,000	25.00	—	13.94	2.09	65.76	8.36	40	
6	do	1,000	25.00	—	10.5	1.3	42	5.2	24	Subject No. 2.
7	July 17	1,000	25.00	+	8.82	.56	35.28	2.24	22	
8	do	1,000	25.00	+	6.97	.69	27.88	2.76	24	
9	July 18	1,000	25.00	—	7.75	1.83	31	7.32	23	
10	July 19	1,000	24.4	—	7.6	1.7	31.1	7	23	
11	do	1,000	24.4	—	8.19	2.58	33.5	10.5	24	
12	July 20	1,000	24.4	+	11.44	1.08	46.7	4.43	24	
13	July 22	1,000	25	—	2.93	.62	9.72	2.48	40	
14	July 23	1,000	25	+	1.60	.14	6.4	.56	40	
15	July 25	1,000	25	—	7.06	1	28.24	4	40	
16	July 20	1,000	25	+	6.27	2.23	25.08	8.92	25	Subject No. 3.
17	July 22	1,000	25	—	9.48	2.55	37.92	10.2	25	
18	July 24	1,000	25	+	4.97	.66	19.88	2.64	30	
19	July 25	1,000	25	—	6.84	1.39	27.36	5.56	30	

Experiments 1 and 2, which were made without previous washing of the stomach (no food having been taken since the night before), agree fairly well with the others, showing that the digestive process is not rendered abnormal by previous washing. In the case of subject No. 1 the amount found in the stomach was constantly greater when the diastase was omitted; the percentage of food taken which was left in the stomach after 40 minutes being, without diastase, 52.02; with diastase, 29.2. This means that of 100 parts of food taken, 100 - 52.02, or 47.92, were absorbed in the one case, and 100 — 29.2, or 70.8, in the other; so that with the diastase nearly half as much again was absorbed as without it. Of the solid matter found in the stomach more than twice as much was found to be undissolved when the diastase was omitted as when it was used.

With subject No. 2 a shorter time (24 minutes) was given for digestion and no marked difference appeared between the two foods; but when the time of digestion was extended to 40 minutes the malted food again asserted its superiority, the amount of this unabsorbed by the stomach being only one-third the amount of plain food unabsorbed. In the case of subject No. 3 the difference in favor of the malted food was made manifest in 25 minutes. In every case, therefore, digestion was more rapid with the malted than with the unmalted food. Thus the physiological evidence confirms the chemical evidence in favor of the food prescribed. Finally, clinical experiments with the soluble food, made according to recipe No. 1, have given as good results as any system of feeding employed at the babies' wards of the Post-graduate Hospital, as detailed in the accompanying paper by Dr. Chapin. It is intended to employ the method of quantitative stomach washing in other cases, as it seems adapted for testing foods and digestive ferments in general.

This food can be easily and cheaply prepared in any household and while the starch is changed to more soluble forms, there is not an excess of sugar. Herein it is superior to the various Liebig's foods. The nutritive value of the albuminoids is likewise not lost sight of. Either barley, wheat, or oatmeal may be thus treated, the principal difference being the varying proportions of fat contained in these grains. According to Dietrich and König, the percentage of fat is as follows: Barley, 2.09; wheat, 1.55, and oats, 6.09. This may be borne in mind in prescribing for diarrhœas and the various forms of indigestion. The effect of malt upon milk is to favor its digestion and assimilation. Garup Besanez, a German authority on malt, has found a ferment in the germinated seed of vetches, hemp, flax, and barley, which very energetically converts starches into grape sugar and albuminous substances (fibrin) into peptones. It was afterwards found that diastase has no action upon albuminoids; but peptase, which is generated in germinating grain at the same time and under the same conditions as diastase and practically they can not be separated, acts upon proteids slowly at low temperatures. This substance is an analogue of the vegetable proteolytic ferments found in pineapple juice and the papaw plant.

The actual results obtained from the use of food thus prepared in the babies' wards have been good, considering the class of cases treated. During May, June, and early July, 37 infants suffering from various degrees of gastro-intestinal irritation and inflammation and from 1 to 10 months old, were thus fed. Seventeen increased slightly in weight after a week or so, 16 lost a little in weight, and 4 remained stationary. As is well known, the loss of weight in gastro-intestinal affections during infancy is usually well marked, and is exceptionally rapid in hospital and institution infants. So extremely susceptible are young infants to hospitalism that they invariably lose weight after a certain interval of time, and will die of inanition under any system of artificial feeding unless removed in season.

A baby admitted May 26, 1 month old, having had convulsions from gastro-intestinal irritation, exemplifies this fact. The weighings are registered as follows: On admission, 6 pounds 1 ounce; May 30, 6 pounds 4 ounces; June 2, 6 pounds 6 ounces; June 6, 6 pounds 8 ounces; June 9, 6 pounds 5 ounces; June 13, 6 pounds 2

ounces; June 16, 5 pounds and 10 ounces; discharged. The gastro-intestinal irritation subsided and the baby did well on its food, but at the end of two weeks it began to show the effects of hospitalism, although there was no vomiting or other sign of indigestion. When sterilized milk, diluted to the proper point with water, limewater, or plain barley water, has been used, there is almost invariably a steady and slow loss of weight from the first, so that the change so often noted upon malting the preparation can not fail to be gratifying.

Dr. Judson C. Smith, who is the district visitor for the hospital, seeing a certain number of the cases after they have been discharged, tells me he has used the extract of malt to peptonize milk about one year, both for infants and adults, with very satisfactory results. Babies from 4 months to 1 year old, when losing weight on other methods of feeding, have usually gained flesh and improved in every way on milk prepared with malt. One tablespoonful of malt is added to a pint of milk, which is heated from 20 to 30 minutes and then brought to the boiling point. The milk is then diluted with water according to the age of the infant.

THE PRODUCTION OF COW'S MILK DESIGNED FOR INFANT FEEDING.

By HENRY L. COIT, M. D., of Newark, N. J.

Science is about to conclude that the accidental impurities in milk, together with the defects in its nutritive values, are among the greatest causes of death to mankind. Milk, as a food, seems to be indispensable to the human race, supplying, with water, both meat and drink in early life. It is therefore of the greatest importance that we, as physicians and sanitarians, should establish a strict surveillance over the sources of supply. The perils growing out of a defective food supply appeal with special force to the physician and, through his clinical observations, are usually first apprehended by him. The great importance of cow's milk as an article of food, its universal use in all periods of healthy life, its necessary use in the sick room, its rapid deterioration at ordinary temperatures, its liability to absorb, develop, and convey the material causes of disease, make it imperative that its production and its sale be subject to the most careful scrutiny, and that measures be adopted whereby qualified persons shall enforce a proper care of the animals, prevent unsanitary surroundings, the gross neglect of cleanliness, and the fraudulent practices which, in many instances, characterize its production.

If physicians were more generally informed concerning the need for concerted action in this matter, we believe it would not be long before the now fatal results to man from impure, infected, and defective cow's milk would be greatly limited; and the mortality from tuberculosis, so largely due to our association with the bovine species, and the fearful havoc among infants would be narrowed within bounds which would not strike terror to our hearts.

In the present state of affairs it has become necessary that the medical profession should resort to active measures to protect their own interests and those of their patients against the horde of dangers which menace the life of our race through this one product alone. This is evident in the United States at least, from the fact that the larger and more powerful commercial interests are so closely bound up with the 4,000,000 dairy farmers, three-fourths of whom contribute something to our milk supply. That a very radical reform is needed in the production of cow's milk is conceded by all who, by their clinical experience, have been obliged to solve the problem of artificial infant feeding. This is also shown by a careful study of the mortality rates from among children under 1 year of age, a very large proportion of whom die of nutritional disorders, directly traceable to unwholesome milk. When it is considered that this infant mortality comprises about 30 per cent of that occurring in all ages and from all causes, we can not escape the conclusion that the

medical profession, and especially those who are equipped for the warfare, have an important duty to perform. Were it not that the foregoing was a sufficient reason for instituting a change in dairy methods, the fact that cow's milk is so generally employed for clinical purposes would amply justify such a course. Physicians very often fail to secure desired results in their work because of impoverished milk; it is therefore no less an important medical feature of the subject that so large a proportion of those under our care must be fed upon this article alone.

The current injurious practices which are common at the dairy are very numerous and are found at every step of the production from the breeding of the animal to the delivery of the product. Chief among them are those pertaining to the housing and care of the animals, the feeding of the same, the careless methods of collecting, handling, and cooling the milk, together with the total disregard of its delicate nature in transportation. It is difficult to understand why the dairy cow, which is so universally employed for human food, should receive relatively so little care when other domestic animals are so cautiously guarded. It is a practice so rare as to be remarkable that the milch cow is housed and kept as comfortably or groomed and cleaned as carefully as the horse. As to the feeding, the cow, the most valuable domesticated animal from an economic point of view, is the only one that is fed on refuse materials. The injurious and fatal consequences of this universal custom are too apparent to require comment; and to those who are not familiar with the facts the prevalence of these evils is astonishing when inquiry is made. As to the expedients resorted to by those who for commercial ends would utilize the waste byproducts, nothing too strong can be said in condemnation of their methods. By far the most prominent substance of a questionable character used for feeding cows to-day, especially near cities, is brewers' grains, known as beer or ale grains. There are probably few dairymen near large cities who do not use it to some extent. It is supposed to increase the flow of milk, which it does by augmenting the bulk of the output about 30 per cent. The cost is small, being in summer about $3 a ton, and on this account it is employed. It is wet when sold, contains 80 per cent of moisture, easily undergoes putrefactive fermentation, and is often given to the cows in this condition. The original 70 per cent of starch and dextrin has been removed from the barley in the malting process, leaving nothing of a nutritive value but 10 per cent of proteids (the gluten) together with the cellulose. The effects of this diet are to impair the digestion of the animal, lower her nutrition, and probably to render her an easy prey to tubercle. On the milk the effect is a product which has poor keeping qualities and when it is used in large quantities materially alters its constitution. We are convinced that our failures with this milk in infant feeding are due to the rapid changes which uniformly occur in it and which are probably due to the unstable character of the fats which it contains. These volatile fatty principles, being easily broken up in the alimentary canal of the child, liberate the fatty acids which act as irritants. There is no dearth of suitable feed and fodder for the milch cow and a synthetical mixture made of waste materials is not calculated to appeal to the ordinary ideas of correctness and is certainly not permissible when the object is the production of food designed for the most delicate human organism.

Physicians can not afford to make concessions in these matters; that which they require can not be gained in this way; any indorsement of the use of waste byproducts for reasons of economical expediency, even when modified, would be misconstrued by milk producers and interpreted to palliate their use in any condition.

Between production and transportation a host of evils have arisen; yet none are more flagrant than the neglect of those commissioned to guard this all-important dairy product at our door. The milk inspector, with his local board of health behind him, are not, we think, efficient. With all their autocratic powers they do little to improve the milk supply in large cities. While these officers are handicapped by the lack of a proper State supervision at the sources of supply, yet they could set a safer

and more rational guard against impure milk than simply its specific gravity and its total solids. Milk must be poor in the extreme, in appearance, keeping qualities, and nutritive values to be quarantined by the inspector in our cities. Indeed, a large part of the milk now received passes without question the blockade of the local officer and yet it is positively unfit for the diet of the infant.

For unexplained reasons, the advance in civilization has been coincident with the failure of the race to nourish its young, and to-day artificial feeding has become an important factor in the work of the clinician. When we remember that an infant consumes during its first year about 500 quarts of milk, and that it requires but a slight variation in the conditions of milk to determine many of the fatal diseases incident to this period, not only are clinical standards essential, but a direct relation is established between the character of the food and infant mortality. Hitherto there have been no uniform clinical requirements of cow's milk from the standpoint of infant feeding. Physicians have been too much occupied through the literature of the manufacturing vender with problems of dextrose, maltose, saccharose, unconverted starch, vegetable fat, and disintegrated milk fat to give serious attention to more rational methods.

If we would obtain uniform results in the nutrition of the young, certain conditions of purity in milk are demanded and must be maintained without variation. It is well, therefore, that we should consider our needs as touching this basis for rational infant feeding, since it is a matter which affects our interests at so many vital points. We are on the threshold of a revolution in infant feeding, and while for several years the manufacturers of artificial infant food have been engaged in efforts to humanize various elements of the lower kingdoms, the profession have been chiefly occupied in trying to harmonize all the discordant views arising from the horde of irrational methods that have thus been foisted upon our attention. This state of things is fortunately being changed. More rational and scientific inquiries are now in progress; so that to-day those who have followed the more recent workers in this field and have adopted the results of their laborious work have been amply repaid. In order to fulfill the needs of infancy and childhood in the present state of our knowledge, three conditions of purity in cow's must be unfailing.

First requirement.—Absence of microörganisms in milk, especially of the pathogenic varieties. This may be easily accomplished so far as disease-producing bacteria are concerned, but germ-free milk has never yet been made practicable. When it is brought about it will be through a reform in the collection and handling of milk, and will include not only the personal cleanliness of those who draw it, but scrupulous care in sterilizing all utensils and milk containers, together with an atmosphere made clean by freeing it from the dust derived from the animal or her immediate surroundings. Microörganisms are found in all milk after it is drawn. Over forty varieties have been isolated from a single specimen of otherwise normal milk. They are never present in the udder except as found when the animal is diseased. Therefore they have their origin in outside sources, namely: The hands of the milker, the udders of the cow, the dust from hay or straw under the animal's feet, the loft and ceiling above, from the air which is constantly in motion, and the dirt left in improperly cleaned milk containers. These bacteria could not have a more favorable medium for their growth and multiplication than fresh milk. The conditions of warmth, moisture, and an animal secretion combine to favor their development. Along with the poisonous ptomaïnes they are capable of producing, these bacteria are, by their presence and growth, the cause of the various fermentations which occur in milk. Ordinary cow's milk of fair keeping qualities contains about 4,000 bacteria in a half cubic centimeter; ordinary store milk from cans has been found to contain from 38,000 and upward in the same amount of fluid. It will be a great achievement if these can be eliminated from the milk and we can obtain that which will keep without extraordinary care. Surely infant mortality must thereby be materially decreased. Pathogenic bacteria are often conveyed through the medium of milk

and it is probably true that no agent carries a greater variety. In this way tuberculosis is spread and the extent of the havoc with life from this source will probably never be known. This particular danger assumes greater magnitude when we remember that probably 30 per cent of the dairy herds in this country have one or more tuberculous cows among them. It is likewise clearly established that scarlatina, diphtheria, and typhoid fever are brought from persons who, either recovering from the disease or associated with it, are at the same time engaged in handling milk, or from untidy milkmaids who, between the milkings, are attendants on persons sick of these disease while they are prevalent.

Second requirement.—A constant and unvarying resistance to change during the first sixty hours after it is drawn. The changes occurring in cow's milk are determined by conditions surrounding the collection, handling, cooling, and care of the milk at the dairy farm, and while the lactic fermentation can not be long delayed, even by the greatest care, yet it is a want of proper precaution that brings about these early changes. The normal temperature of the cow, and therefore of fresh-drawn milk, is about 100° F. To insure its keeping qualities is to prevent the growth of bacteria. This is best done by quickly reducing its temperature with ice to about 45° F. and maintaining it at this point until used. Thus treated in clean vessels, milk will keep several days. Several samples of ordinary superior milk submitted by myself to Prof. Albert R. Leeds, Ph. D., were kept by him in his laboratory refrigerator for eleven days without change, the temperature of the chest ranging from 34° to 54° F. Where well-water only is available for cooling purposes, the above conditions can not be brought about, since well-water has an average temperature not above 48° F, and with it milk can not be reduced and maintained below 54° F. The cooling of milk immediately after it is drawn is probably the most efficient means known for retarding its fermentations, and it follows that since cold prevents the growth and the activity of bacteria, the earlier the cooling is effected the longer the milk will remain without change.

Third requirement.—A constant and unvarying nutritive value of known composition. This can doubtless be realized through an intelligent feeding of the animal, based upon chemical researches, conducted with a view to an adjustment between breeds, their feeding and the product required. The diet of the milch cow in its bearing upon the constitution of her milk has been studied chiefly with reference to the economical side of dairy farming. At agricultural experiment stations the objects have been to determine the cost of foods. Little has been done with reference to the effects of various foods upon the ultimate nutritive values of the milk. That due attention must be paid by the feeder to the particular purpose for which the cows are kept is conceded by all who are familiar with the subject. Thus for butter, for cheese, or for infant feeding, a special and accurate adjustment of nitrogenous substances and the carbohydrates must be observed with reference to the product required. This is accomplished by a proper admixture of grass, hay, fodder corn, and various tubers with solid cereal grains of different kinds ground into meal. The cheap and exhaustive foods used so largely to increase the milking capacity of the cow do not even approximately fulfill these requirements.

The most variable constituents of milk are the fats. The sugar and albuminoids are the most constant elements of its composition, so that in looking for dangerous modifications in milk chemists would do well to examine more closely into the nature of its fatty compounds, especially the volatile principles which so easily undergo changes. Although the sugar and mineral salts are quite uniform in all milks, the remaining serum solid known as casein may in different breeds vary as much as 2½ per cent, which would seriously affect its value in infant feeding. The high percentage of albuminoids has been the chief obstacle in the way of a more general use of cow's milk in feeding. The methods in vogue for diluting it in order to make it correspond to woman's milk are somewhat difficult when these elements are higher than 4 per cent. It seems, therefore, that any

method that promises to maintain the fat and sugar percentage, and yet reduce the casein, is desirable when the milk is to be used for infant feeding. The writer has had an opportunity of demonstrating the utility of a method which we commend to your careful attention. The reported analysis of milk from the breeds usually employed show the albuminoids to be uniformly in the proportion of from 4 to 5 per cent. By making a combination of a thoroughbred Jersey, a thoroughbred Holstein, and two common American grades, the first giving a milk rich in fat, the second a milk rich in sugar, and feeding the animals with a view to reduce the albuminoids, we obtain a result when the milk is mixed which we believe to be valuable. The following analysis made for the writer by Prof. Albert R. Leeds shows that the combination in this instance reduced the albuminoids to 3.36, while the fat and sugar are maintained at a normal high standard. A good feature of this milk is that it approximates more closely to woman's milk in its color, its total solids, its taste, and its reaction, which is neutral. The results of the experiment are offered as a basis for future observations, and also suggestive of a possible means of securing an ideal milk for infant feeding. The analysis as made of 24 samples, submitted on June 7, 1893, was as follows: Color, white; smell, sweet; taste, sweet; reaction, neutral; specific gravity, 1.030. Water, 86.88 per cent; total solids, 13.12 per cent; fat, 4.39 per cent; sugar, 4.42 per cent; albuminoids, 3.36 to 3.60 per cent; ash, 0.71 per cent.

In seeking a remedy for the difficulties which surround the milk supply, especially in large cities, we find that it must lie within three possible lines of action.

Legislation.—This is a common channel through which to appeal for reforms; with the question before us, however, our efforts have hitherto been unavailing. Legal enactments will not afford us the needed relief, since their passage have so often resulted in their being embalmed in the statute books. These laws would be sufficient if they were administered: but that they are not effectual is apparent to all. Our legislative bodies seem helpless when their dictum runs counter to commercial interests.

Public opinion.—This is always variable and capricious and through the influence of the public press is largely molded by vested interests. As a force to be used for reform, it is therefore unreliable. Moreover, the public are proverbially lax and indifferent with reference to matters connected with sanitation and hygiene. Destruction of property arouses alarm, but a sacrifice of life on the altar of greed or ignorance is not sufficient to awaken the concern of the masses.

Medical supervision.—The physician is the proper custodian of matters effecting public health; he is also the only proper agent to meet the conditions which menace human life. His knowledge of the causes and sources of danger best equip him with the means of warfare against current evils of this class. The feeding of the young in infancy and childhood, the approach of infection, which in many instances calls for unusual judgment in the selection of their food, and the many clinical relations of the milk supply, all combine to impose upon the physician important responsibilities, and to make him the proper supervisor of milk production where it is designed for his purposes.

In order to secure all that we desire in cows' milk for dietetic purposes, namely, freedom from bacteria, reliable keeping qualities, and uniform nutritive values, we propose the following plan, whereby the above-mentioned conditions may be acquired under our own supervision. This plan, which is now about to be put in practical operation by a medical commission organized by the writer in Essex County, N. J., includes three general requirements, each of which is essential, and we believe, if taken together, will establish a reliable safeguard:

(1) That physicians give their practical encouragement and support to labors conducted by a commission of medical men, selected from their own number, who shall endeavor to secure a supply of milk produced under such regulations that purity may be assured.

(2) That approved and trustworthy dairymen, possessing honor, financial ability, and dairy facilities, shall be induced, by reason of promised medical support and the increased price of their milk, to conduct their dairies, and collect and handle the product in conformity with a code of requirements made by the aforesaid medical commission and imposed by them in due legal form. This contract between the commission and the dairyman under their patronage shall be stringent and binding. It shall include ample sureties for its fulfillment, the necessary forfeiture clauses, a territorial limit for the sale of the product, provision for the compensation of experts employed by the commission, which shall include a chemist, a bacteriologist, and a veterinary surgeon. It shall also control the location and character of the land employed for pasturage or for the cultivation of materials for fodder. It shall determine the construction, location, and drainage of buildings in so far as construction, location, or drainage may effect the health of the dairy stock, the removal of waste, or the character and conditions of the milk. It shall provide for an abundant and pure water supply, and prevent the use of water from shallow wells or springs holding surface drainage, or the use of any well or spring located within 300 feet of the stable. It shall include the protection of the stable and stock from a want of cleanliness and order; eliminate dirt, rubbish, and decayed animal or vegetable waste from the premises; and disallow the keeping of fowls, hogs, horses, or other live stock, except the cow, within 300 yards of the buildings used for dairy purposes. It shall regulate the health and breed of the animals, and exclude from the herd any animal that is judged by a competent observer to be tuberculous in any organ or part, or any animal with fever or disease proceeding from or associated with parturition, or found to be in a state of ill health prejudicial either to the herd or to the character of the milk, or any animal that was bred through close consanguinity within a period of three generations, or that was not kept sterile during the first twenty-seven months, or any phenomenal milker except that glandular disease or tubercle has first been excluded by a competent observer. It shall provide for the proper housing and care of the animals and their shelter from the influences of weather and climate detrimental to their health; their grooming and treatment; the prompt removal of waste products from the stable, and its freedom from animal odors by proper ventilation; the absence of conditions which would make the animal nervous, and prevent their use for milking purposes when in a state of excitement, either as a result of or during the period of estrux. It shall regulate the feeding, both as regards the materials which will determine the desired result in the product, as well as restrain the use of questionable or exhausted materials employed to increase the milking capacity, or that will result in impoverished milk. It shall govern the collection and handling of the milk, and insist upon a proper regard for cleanliness, as it is viewed from the standpoint of a physician and sanitarian and as it relates to the animal and her surroundings, the milker, the vessels, or to the association of persons handling the milk, with sources of infectious disease. It shall also govern, in minute requirements, every step in the cooling and preparation for shipment, and add to the product every known detail of care that will promote its keeping qualities and favor its safe transportation.

(3) That the commission shall carry on its work without pecuniary compensation. They shall endeavor to establish, from data gathered in clinical observations, correct standards of purity for cows' milk. They shall be responsible for a periodical and personal inspection of the dairy or dairies under their control. They shall provide for a bimonthly expert examination of the dairy stock by a competent and approved veterinarian, who shall be subject to a consulting and a supervising officer. The milk produced shall be subjected to chemical analysis and to bacteriological tests, made by experts under the direction of the commission, at such times as in its judgment is desirable, the cost of which shall be defrayed by the dairyman. The chemist, the bacteriologist, and the veterinary surgeon shall be selected by the commission; and when so requested, either periodically or otherwise, they shall

render their reports in writing. After receiving these reports the commission shall send a certified copy of the same to the owner or agents of the dairy under its supervision. This triple certificate, duly signed, shall constitute the product of the dairy "certified milk," provided it shall be sealed in separate quart containers marked "Certified milk," and bear the name of the producer, together with the date of milking. Being designed especially for clinical purposes, it should be subject to the following restrictions in its sale, namely, that when at any time the demand should exceed the supply, and the milk is required by a physician, either for infant feeding or the diet of the sick, the holder of a physician's order shall be regarded as a preferred purchaser. The reports of the experts, although designed for certificates, may also be used for the information of the medical profession in the localities where the milk is sold. Duplicate printed copies, bearing the signatures of the experts and the names of the commission, should be sent out at such times as may be agreed upon, and the circulation should, for obvious reasons, be limited to the physician.

APUNTES SOBRE LA ALIMENTACIÓN EMPLEADA DURANTE LA PRIMERA INFANCIA EN LA ISLA DE CUBA.

Por el Dr. JOAQUIN L. DUEÑAS, Habana, Cuba.

Este trabajo, escrito con el objeto de satisfacer en lo posible los deseos manifestados por los Dres. Keating y Crandall, de los Estados Unidos, servirá para dar una idea general sobre el régimen alimenticio seguido durante la primera infancia en los niños de la Isla de Cuba. Una información rápida, practicada en diferentes localidades de la Isla, me ha permitido reunir datos de algún valor y complementar los conocimientos prácticamente adquiridos durante mi vida profesional en la Habana.

Desde un punto de vista general, puedo decir que la alimentación de los niños pequeños no está sujeta entre nosotros, sino con raras excepciones, á los sanos preceptos de la ley natural ó á los prudentes dictados de la ciencia. En cada provincia, en cada pueblo, en cada familia, existe un modo de criar distinto, impuesto por los hábitos heredados de varias generaciones. El destete lo realiza cada uno á su manera, casi siempre sin consultar la opinión del médico, sin cuidarse para nada de la trascendencia del acto que va á realizarse, ni de los peligros á que se expone la vida del niño, que atraviesa ese período crítico de su desarollo, con más ó menos fortuna, según su resistencia individual.

En las poblaciones de alguna importancia, en la Habana, por ejemplo, se vé por todas partes el abandono hasta de los más elementales preceptos. Lo arbitrario es la línea de conducta que se sigue. En los campos no existen costumbres más sanas, y á cada paso tienen que luchar los médicos con los resabios de la ignorancia. Con objeto de contribuir á la desaparición de hábitos muy generalizados, cuyos efectos se reflejan en la estadística de mortalidad, publiqué el año pasado de 1892 una serie de artículos sobre el "destete" en La Higiene, periódico de vulgarización científica que dirige mi amigo el Dr. Delfín.

Alimentación natural.—La lactancia materna se emplea en toda la Isla, pero de distinto modo y con diferente resultado, según se considere en las capitales, en los pueblos de más ó menos importancia, ó en las viviendas rústicas.

En la Habana las condiciones del medio, densidad de población, calores excesivos, humedad, á las que se agregan otras muchas causas de orden biológico ó sociológico, contribuyen á debilitar la constitución de nuestras mujeres, y por lo tanto muchas de ellas no pueden resistir, sin peligro para la salud, las pérdidas que ocasiona una lactancia prolongada. Salvo relativas excepciones de señoras que tienen todo el vigor necesario para soportar una lactancia hasta los dos años del alumbramiento, la mayoría de las habaneras se resiente al cabo de cierto tiempo del gasto orgánico

empleado en beneficio de la criatura, viéndose precisada á acudir á la lactancia mixta artificial. Es muy general ver que los niños de pecho se mantengan con buenas apariencias de salud y lozanía á pesar de alguna decadencia de fuerzas en las madres, pero no es raro, por otra parte, observar en los niños la dispepsia por alteración cualitativa de la leche, la debilidad constitucional, la atrepsia. En tales casos lo más provechoso para ámbos organismos sería, ó la lactancia mixta femenina, en la que una nodriza mercenaria alterna en sus funciones con la madre, ó el cambio definitivo de nodriza, según lo exigieren las circunstancias. La lactancia mixta femenina no deja de emplearse algunas veces, pero las familias optan con más facilidad por la alimentación artificial por ser muy común la repulsión que se tiene á las nodrizas mercenarias, la mayor parte de la raza de color, dadas las pésimas condiciones en que se encuentra el servicio doméstico á consecuencia de tantos factores sociológicos como han contribuido fatalmente á su desorganización. Si á las deficiencias morales del servicio se agrega el elevado precio ($30 á $85) que exigen las nodrizas en la ciudad, se acabará de comprender porqué casi siempre se prefiere la lactancia mixta artificial. Esta determinación se realiza frecuentemente del quinto al noveno mes de la vida del niño, algunas veces antes, pero deja probada invariablemente la virtuosa disposición de la mujer cubana á amamantar sus hijos, á pesar de no permitírselo en muchas ocasiones la pobreza constitucional de su organismo.

En cuanto á las condiciones orgánicas de las nodrizas mercenarias, debo agregar que las mejores son las de raza negra; poséen una leche más rica, más nutritiva y soportan varias crías consecutivas, sin resentirse apenas en su salud. También son buenas las nodrizas de Canarias y las peninsulares, en su mayoría gallegas, cuando traen sus hijos; pero la regla general es que emigren dejándolos en su país y exponiéndose á perder considerablemente la secreción lactea depués de una larga y penosa traversía.

En la Casa de Maternidad se emplea la lactancia natural como alimentación exclusiva de los niños de pecho. Los siguientes datos me han sido suministrados por mis distinguidos amigos, el Sr. Coppinger, celoso director del establecimiento, y el Dr. Montalvo, médico de la Maternidad. Cada niño tiene su nodriza destinada á cuidarlo y attenderlo á la vez que amamantarlo. Se le abonan $30 mensuales, sufragándole los gastos accesorios de lavado de ropa, alimentacion, confeccionada en una cocina especial, alimentos especiales, chocolate, etc., lo que hace aumentar el presupuesto para cada una á $47 mensuales. Para saber lo que cuesta el sostenimiento de esa sección, basta saber que anualmente ingresan de 27 á 28 niños por el torno destinado á recibirlos. El destete se realiza gradualmente bajo la directa inspección del Dr. Montalvo, y se da el caso de ver niños de cerca de dos años que ya toman otros alimentos y todavía tienen una nodriza que les brinda maternalmente el pecho á ciertas horas.

En el interior de la Isla se emplea generalmente la lactancia materna para alimentar á los niñitos, pudiendo asegurarse que casi todas las madres dan exclusivamente el pecho á sus hijos durante los tres ó cuatro primeros meses de la vida y luego alternativamente con otros alimentos hasta una edad avanzada (dos años). El modo de administrarlo no está sujeto á otra regla que al capricho ó los hábitos de cada familia, siendo muy frecuente causa de trastornos intestinales la costumbre de amamantar con exceso al niño, ya durante el día, ya en las horas de la noche.

Alimentación artificial.—En la Habana se practica el destete prematuramente, pero por lo común de un modo gradual. La época que se escoge para empezarlo es la que trascurre del cuarto ó quinto mes al noveno, ya bajo pretexto de nuevo embarazo ó porque la madre cree debilitarse sosteniendo el niño á pecho solo. En muchos casos el empleo de la alimentación artificial obedece al deseo de fortalecer y engordar niños que no lo necesitan, que viven saludables y se hallan en buenas carnes, logrando con esto volverlos dispépticos y delicados ó enfermarlos gravemente. Esa es una tendencia bastante generalizada en nuestro país.

El alimento á que se dá la preferencia por su abundancia y baratez es la leche de vaca. Casi siempre se la administra hervida, en la proporción de dos partes de leche por una de agua, esto es, terciada, asociándole agua de cal ó de Vichy, bicarbonato de sosa, anis, cebada, té, con objeto de prevenir los trastornos que su digestión pudiera ocasionar. Sinembargo todas esas precauciones son inútiles para conjurar los peligros que resultan de las alteraciones que sufre la leche ya por la mala calidad de los pastos al entrar la primavera, ya por las múltiples causas de que he hablado en mi trabajo sobre las entero-colitis. En el empleo de la lactancia mixta artificial se cometen las mismas faltas que en la lactación materna. Es raro que se sujete al niño á un verdadero régimen basado en una higiene alimenticia bien entendida. No hay técnica sino en los casos en que interviene para dirigirla el médico de la familia; por consiguiente la única precaución de asepsia que se toma es la consagrada tradicionalmente por el uso, de hervir la leche varias veces al día, sobre todo en los meses calurosos del verano.

Desde el año de 1890, en la misma época en que comenzó á hacerse uso de la leche esterilizada en el extranjero, los Dres. San Martín y Fors empezaron sus ensayos de esterilización por un procedimiento especial en el Laboratorio de la Crónica Médico-Quirúrgica, y utilizando poco tiempo después la leche de excelentes vaquerías situadas en el occidente de la Isla, proporcionaron al consumo en los mercados, una magnífica leche esterilizada al vapor bajo presión en el autoclave, á una temperatura de 115 á 120 C. Esta leche que se vende desde entónces á 10 centavos la media pinta, ofrecía una buena garantía para la salud, siendo acogida favorablemente por el público que llegó á consumir desde que se implantó la mejora, unas diez mil botellas mensuales. Leche buena, superior á todas las que se expenden en la Habana, y además aséptica, estaba llamada á influir poderosamente en la conservación de la salud infantil, si la técnica especial que requiere para su administración fuese escrupulosamente practicada por las familias. Desgraciadamente no da resultados seguros mas que en aquellos casos en que la cultura individual se halla dispuesta á comprender los trascendentales beneficios del progreso.

Recientemente el Dr. Delfin ha ideado un pequeño aparato cuyo uso empieza á generalizarse, y que tiene por objeto esterilizar la leche que ha de consumirse durante el día, por medio de un sencillo procedimiento puesto al alcance de las familias.

El uso de la leche de burra en la Habana está restringido á un número menor de niños, y puede decirse que solo se toma por prescripción facultativa. La leche no es generalmente de buena calidad por deficiencia en la conservación y sostenimiento del ganado, y su precio no está al alcance de todas las fortunas. La leche de chiva ó cabra es muy poco usada, lo mismo que la de yegua cuyo empleo es excepcional.

Los alimentos que se preparan en el país para ayudar el régimen lacteo ó para sustituirle por completo, cuando el destete es definitivo, consisten en atoles ó papillas que se confeccionan con diversas harinas á las cuales se adiciona caldo más ó menos desgrasado, ó leche y azúcar. Este es el modo más común de comenzar la alimentación. La harina de trigo, de sagú, la maicena, la tapioca, la galleta pulverizada, la bananina ó harina de plátano, son las sustancias de uso más frecuente. También se emplean las *migas*, que se hacen con pan mojado en agua ó leche y un poco de sal, echando el todo en manteca hirviendo con ajos, hasta obtener una pasta de cierta consistencia que los niños toman con agrado. Las sopas de pan, las de leche, á la que se agrega azúcar y canela, las sopas de fideos ó tapioca, las patatas, el arroz con leche, son los primeros y más usuales alimentos, dejándose para más adelante los huevos, ciertas viandas, el pescado, ave ó carne.

Aunque este es el modo habitual de comenzar la alimentación de los niños en las familias habaneras, se dan casos no raros de trasgresiones higiénicas que consisten en hacer ingerir prematuramente sustancias de difícil digestión, incompatibles con el estado de desarrollo de los órganos digestivos. Legumbres diversas, frijoles y

judías principalmente, guisos variados como el de maiz, que los niños no mastican bien, quesos, dulces y golosinas de todas clases, que suelen producir gravísimas indigestiones y enteritis consecutivas.

Los alimentos artificiales que se importan del extrangero pueden ser colocados, según el diverso consumo que de ellos se hace, en el orden siguiente, teniendo en cuenta los datos que he recogido en diversas droguerías importadoras de la ciudad: leche condensada americana y suiza, harina lacteada de Nestlé, fosfatina Fallieres, alimento de Wagner, de Mellin, de Savory y Moare, harina malteada Defresne, grano imperial. De todos ellos se hace un uso variado como alimento supletorio ó adicional, ateniéndose á las indicaciones expresadas en los prospectos para su modo de administración y dósis. El que más se emplea es la leche condensada americana y muchas veces como alimento exclusivo, manteniéndose los niños en regulares condiciones de salud. Su poder nutritivo está subordinado en gran parte á la constitución del niño que lo toma. Los niños fuertes que no necesitan de rica y abundante alimentación para reparar sus pérdidas y desarrollarse, se encuentran bien con su uso, pero en la mayoría de los niños habaneros que utilizan la leche condensada de un modo exclusivo, la nutrición se hace con languidez, los colores son pálidos, las carnes blandas, revelan en suma, los atributos del linfatismo y de la anemia. La leche condensada representa, sin embargo, un papel importantísimo en la higiene terapéutica de ciertas dispepsias y enteritis. Cuando no hay el recurso de una buena nodriza y las demás leches no se toleran bien, constituye un alimento precioso para modificar con rapidez el aspecto de las deposiciones.

En el resto de la Isla la alimentación artificial varía según se la considere en las poblaciones de más ó menos importancia, ó en los pueblos pequeños, caserios, haciendas de labranza, sitios, etc. En las capitales de provincia, según los informes que acabo de recibir de varios compañeros, se observan costumbres análogas á las de la Habana. La leche de vaca es generalmente la base de la alimentación de los niños y suele adulterarse en los puntos en que escasea, con agua, leche de boniato ó grasas. En algunos lugares, como en Matanzas, en que no hay leche buena y abundante por haberse convertido muchas haciendas y potreros en colonias para la explotación de la caña de azúcar, ha subido el consumo de la leche condensada americana, el cual aumenta todavía en la estación de la seca á causa de la muerte de muchas reses y por deficiencia de la secreción en las restantes. En algunas provincias en que existen numerosas vaquerías, predomina el empleo de la leche de vaca, porque existe en Cuba la costumbre de repartir el ganado entre los vecinos ó sitieros con el objeto de conservarlo en el tiempo de la seca. Así cada familia puede disfrutar por cierto tiempo de la leche que le produce la vaca que se le entrega, pero desde hace poco los potrereros tienden á restringir dicho reparto en muchos lugares porque las vacas contraen el hábito de destruir las cercas que separan las fincas colindantes enseñando á rompedoras á las otras.

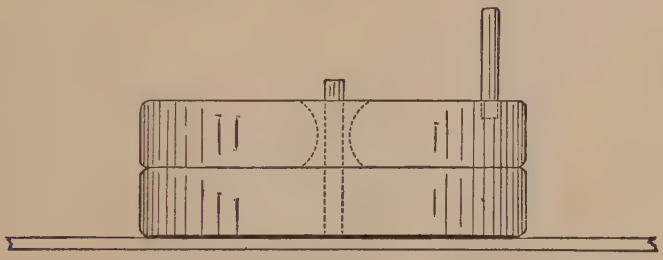
De todos modos, es costumbre muy seguida en los campos dar á los niños, que carecen del pecho de la madre leche de vaca, que se administra casi siempre hervida, pero las más de las veces pura y desordenadamente. También está muy generalizado el empleo de la chiva criandera, concordando en todos sus detalles, los numerosos informes recibidos de toda la Isla respecto al modo que se tiene de aprovechar este animal para la lactancia. Se habitua al niño á practicar la succión directamente y al cabo de poco tiempo la cabra aprende y ejerce sus funciones como una verdadera nodriza, acudiendo solícita al llamamiento de la criatura y acomodándose de la mejor manera posible para facilitar al niño la succión. La cabra se aprovecha en toda la Isla, pero muy particularmente en todo el Occidente, provincia de Pinar del Rio y en algunas comarcas del centro y el Oriente.

En ciertas localidades de la provincia de Santiago de Cuba, en las haciendas de Bayamo y Tiguaní, en que existen grandes vaquerías, se aprovecha para alimentar á los niños el suero obtenido por expresión de la leche, coagulada por medio del cuajo, para la elaboración del queso.

Respecto á la leche de burra y la de yegua, se usan con rareza, cuando el facultativo la prescribe ó el niño no digiere bien alguna de las leches anteriores.

Hay un hecho que debe fijar mucho la atención y que por sí solo basta para juzgar del pésimo estado en que se encuentra la alimentación de la niñez en toda la Isla. Lo defectuoso del régimen consiste en no someter exclusivamente á leche á los niñitos. El acuerdo, en la opinión de todos los médicos que me han escrito, es unánime. Ya disfruten del seno materno en toda su abundancia, ya de una lactancia mixta más ó menos impropia, lo frecuente es que desde el tercero ó cuarto mes, bajo pretexto de que se crian débiles á leche sola, se les pone en la boca primero el pedazo de pan, luego el boniato salcochado, el plátano verde frito ó asado, é insensiblemente se vá desde la sopa de pan ó de fideos á la de arroz, *casabe*, carne ó tasajo para que lo *chupe*, concluyéndose por saber que el niño, sin haber terminado el período dentario, come ya de todo como los mayores de la casa.

Las papillas que se usan al comienzo del destete, entre los campesinos razonables, se preparan lo mismo que he dicho antes, con caldo ó leche, á los cuales se agrega harina de trigo, de sagú cosechado en el país, ó maicena (fécula de maiz). La harina de maiz también se emplea muchísimo, pulverizando el maiz en un molino de piedra cuyo diseño adjunto.



Se echa el maiz por el ancho orificio situado en el centro del disco superior, y por medio de un movimiento giratorio impreso al mango de madera, se tritura el grano entre las dos piedras, las cuales van dejando escapar poco á poco las partículas por el intersticio que las separa. El producto así obtenido se llama rollón y con él se prepara la papilla, agregándole leche hervida y un poco de azúcar.

Con el plátano verde frito, machacado en un mortero, se fabrica también una harina que sirve para hacer papillas, cuyo empleo es general en toda la Isla. Dotada de alguna consistencia ya sóla ó unida á otros alimentos, se deposita en la boca del niño después de haber amazado cierta cantidad entre los dedos. Este procedimiento del bocado tiende á sustituir en muchos puntos del campo al antiguo proceder del mascado, que consiste en introducir en la boca del niño el alimento préviamente masticado ó insalivado por otra persona. El alimento empleado por algunas familias campesinas bajo esta repugnante forma, es el plátano verde frito, transversalmente cortado en angostos discos, ya sólo ó mezclado con pequeños pedazos de carne de puerco ó chicharrón, que no es otra cosa sino la piel del puerco unida á cierta cantidad del tejido celulo-grasoso que la sustenta y que se fríe y achicharra al fuego. También se asocia la carne de puerco al boniato ó al plátano maduro, constituyendo un alimento muy agradable al paladar.

El proceder de la tetera está asimismo muy generalizado. Consiste en colocar un pedazo de pan, de galleta, de panetela ó cidra dentro de un pequeño trapo, sujetándolo después con un hilo, á la manera que se dispone la gasa para el taponamiento intracervical del útero. Hecha la tetera se sumerje en un poco de agua, sola ó con vino ó leche, y se da á chupar al niño, remojándola las veces que sean necesarias.

De los alimentos importados, la leche condensada americana y la harina lactea de Nestlé, son los que únicamente se emplean, siempre en mayor proporción en las capitales de provincia ó en las poblaciones de cierta importancia, que en los pueblos,

caseríos, colonias ú otros conglomerados humanos, donde puede calificarse de insignificante ó nulo el consumo que de ellos se practica.

Sería prolijo insistir ahora en los resultados de tantas trasgresiones higiénicas como se cometen al alimentar viciosamente á los niños, del mismo modo que al sujetarlos á la ingestión de aguas de pozo ó manantiales sin filtrar ni hervir. La dispepsia, la dilatación del estómago, las enteritis, los vermes, la eczema, son las enfermedades más comunes en los campos y en los poblados del interior. Los bebes de vientre grueso se ven por todas partes. Las infecciones de todo género por el tubo intestinal, encuentran un terreno preparado de antemano para realizar con más facilidad sus terribles estragos.

En resúmen: en la Isla de Cuba la alimentación de los niños de la primera infancia no está sujeta á los preceptos higiénicos sino en las poblaciones de cierta importancia y entre las familias de cierta cultura intelectual.

El modo más frecuente de alimentar á los niños es por medio de la lactancia materna durante los primeros meses de la vida. De un modo general puede decirse que son buenas las condiciones de la mujer cubana para el amamantamiento de sus hijos, siendo menos numerosas las buenas nodrizas en las ciudades y debilitándose más pronto que las campesinas.

La tendencia de nuestras madres en toda la Isla es destetar prematuramente á sus hijos sujetándolos, en las poblaciones, á la lactancia mixta artificial; en los campos á una alimentación viciosa, pero sin dejar de darles el pecho á veces hasta los dos años ó más.

La leche á que se dá la preferencia de ordinario es la de vaca por su abundancia y baratez (5 centavos la pinta); en segundo lugar, la de burra en la Habana ú otras poblaciones importantes; la de chiva en los campos, usándose en último lugar la de yegua. La leche esterilizada no se consume más que en algunas capitales de provincia, sobre todo en la Habana y alrededores.

La leche condensada americana y suiza, pero sobre todo la primera, son de uso muy general en ellas, desconociéndose su empleo casi en absoluto entre los campesinos ó guajiros.

Los demás alimentos artificiales que se importan del extrangero son escasamente administrados aún en las capitales, á excepción de la harina lactea de Nestlé.

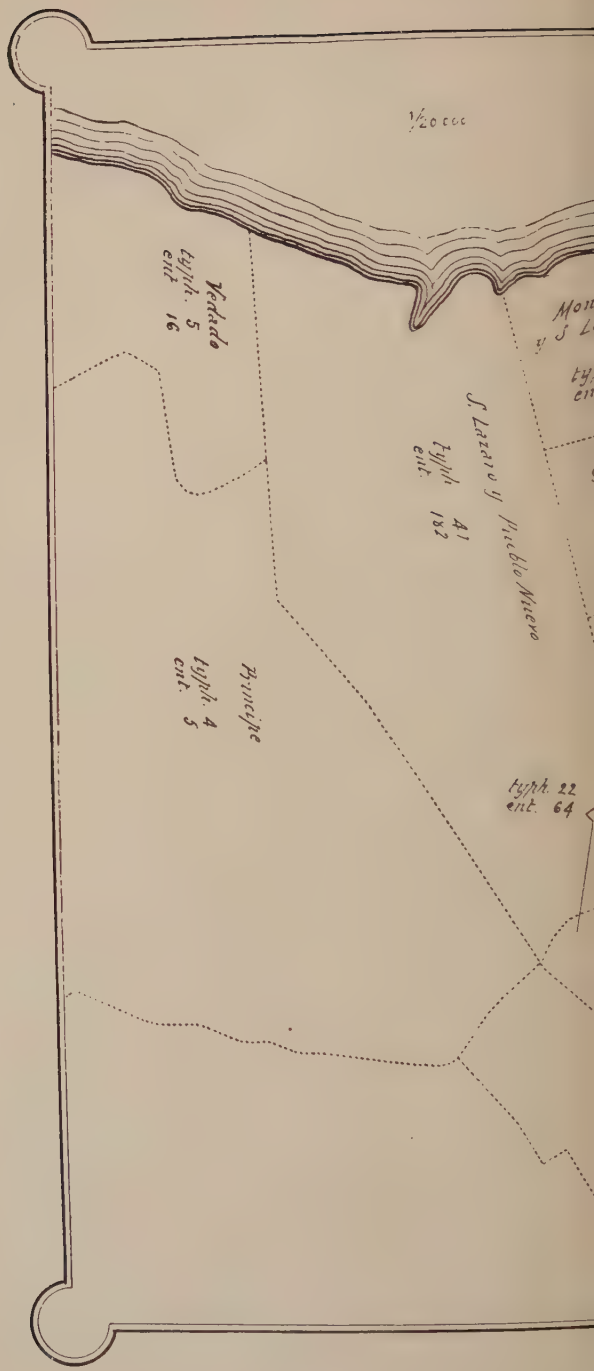
La primera alimentación, confeccionada por el arte culinario en las ciudades, consiste en el empleo de papillas o atoles de sagú ó trigo con caldo ó leche, las migas, bananina, sopas ligeras de pan y luego de fideos, tapioca ó revalenta. En los pueblos de campo se usan las mismas papillas de sagú ó de trigo, pero sobre todo las de harina de maiz y las de plátano verde. Se anticipa el empleo de otros feculentos, como el boniato, las patatas, la malanga, el arroz, etc.

La alimentación viciosa consiste en el uso más frecuente en los campos, pero limitado en las ciudades á las familias de poca cultura intelectual, de sustancias inadecuadas á la edad y desarrollo del niño: ciertos feculentos, como el ñame, la yuca; leguminosas como frijoles, judias, frutos diferentes, algunas veces verdes, dulces de todas clases, helados, quesos y productos más complexos del arte culinario.

No debo levantar la pluma sin dejar consignada mi más profunda gratitud á los dignos compañeros que han querido favorecerme con sus instructivos informes. Los primeros ejercen su profesión en las distintas localidades de la Isla que se expresan; los segundos, residentes en la Habana, han permanecido más ó menos tiempo en el campo:

Dres. Carbonell, Fors (Mántua, Pinar del Río), Perez (de Guane), Valdes Brito (de San Luis), Madan, Cuní, Tomás, Valdés, Anciano (de Matanzas), Cadenas (de Remedios), Cuervo, Garcia Rijo (de Santi Espíritu), Tristá (de Sta. Clara), Betancourt (de Puerto Príncipe), Guimerá (de Santiago de Cuba), Meneses (de Baracoa.

Delfín, Grande Rossi, Borrero, Saenz Yanes, San Martín, Tamayo, Albarrán, y Quiñones de la Habana.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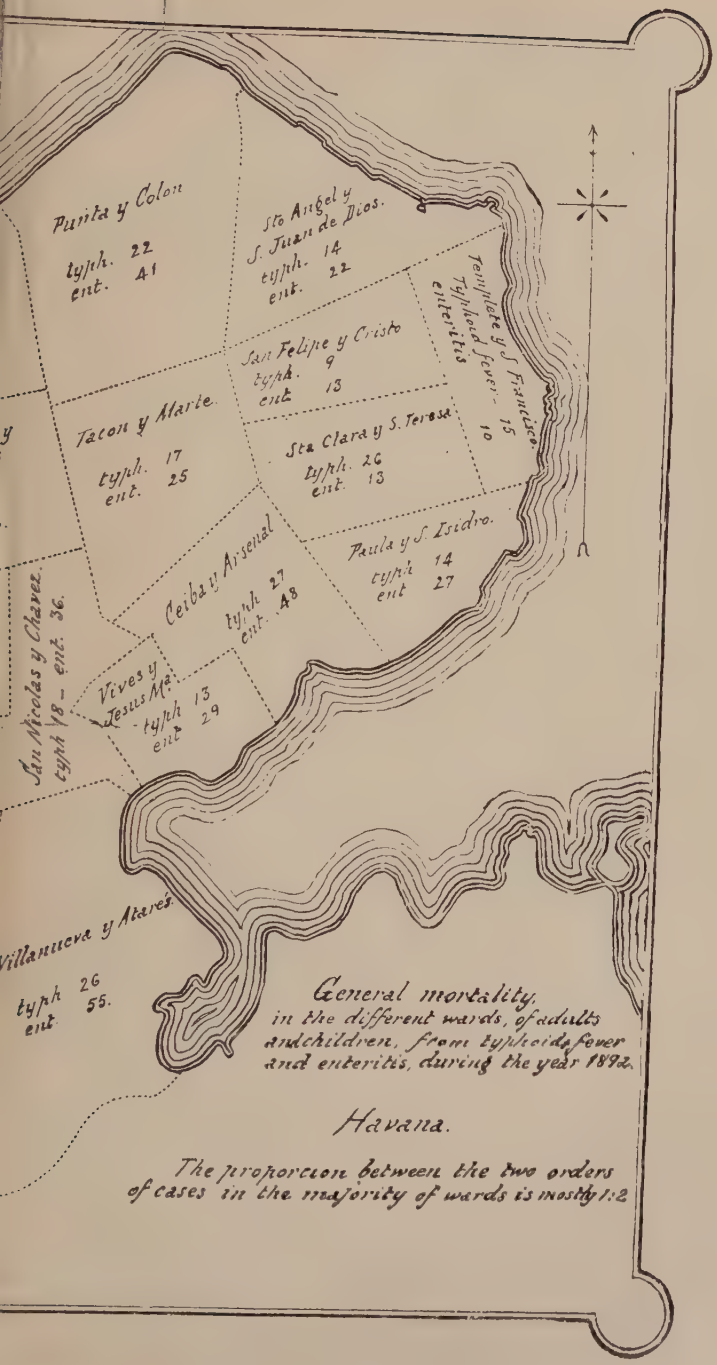
Punta y Colon
typh. 22
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Sto Angel y S. Juan de Dios.
typh. 14
ent. 22
Templete y S. Francisco
Typhoid fever 15
enteritis 10
San Felipe y Cristo
typh. 9
ent. 13
Tacon y Marte.
typh. 17
ent. 25
Sta Clara y S. Teresa
typh. 26
ent. 13
Paula y S. Isidro.
typh 14
ent 27
Ceiba y Arsenal
typh 27
ent. 48
Vives y Jesus Mª.
typh 13
ent 29
San Nicolas y Chavez.
typh 18 – ent. 36.
Villanueva y Alares
typh 26
ent. 55.
General mortality,
in the different wards, of adults
and children, from typhoid fever
and enteritis, during the year 1892.
Havana.
The proporcion between the two orders
of cases in the majority of wards is mostly 1:2

A CONTRIBUTION TO THE STUDY OF PRIMARY ENTERO-COLITIS IN EARLY INFANCY.

By J. L. DUENAS, M. D., of Havana, Cuba.

In Havana, as in all populous cities of either hemisphere, the proportion of cases of and deaths occasioned by intestinal diseases among infants reaches a very high figure. Besides simple diarrhœa and Hayem's green diarrhœa, many cases of acute entero-colitis occur of greater or less intensity, which are either cured by an appropriate treatment or pass into a chronic state, attended sometimes with secondary ailments, which are but the consequence of neglected intestinal troubles.

In order to have an idea of the damages caused by enteritis among the children of Havana it is only necessary to direct one moment's attention to the demographic charts so scrupulously figured out by Drs. Delfin and Laguardia since 1890. Thus, the mortality from enteritis in that year (1890) included 417 children under 2 years of age, equivalent to 5.71 per cent of the total of deaths (7,298) in the entire population. In 1891, out of a total of 7,030 deaths, 1,556 were children under 2 years of age, 566 of them (36.37 per cent) having died of diarrhœa. In 1892 a total of 6,963 deaths were registered, 1,535 of which belonged to early children, 399 (26.99 per cent) having been occasioned by diarrhœa, so that each year between 400 and 550 little children are carried off in this city by acute diarrhœa, equivalent to a maximum of 2.75 deaths per 1,000 inhabitants. If the above figures be compared with those given by Dr. Smith concerning the city of New York during the year 1892 a marked difference will be observed against the Havana mortality, for in New York the mortality among children under 5 years of age only represented 2.90 per 1,000 inhabitants, from which it must be inferred that for children under 2 years of age the mortality would have given a figure much lower than ours. Such results are most harassing in a city which barely contains 200,000 inhabitants, and where the proportion of births to deaths presents an alarming balance against the population. The important factor that we are considering well deserves, therefore, to be taken into account in order to lessen as much as possible its fatal influence.

The observations which I shall present concerning the intestinal troubles of early infancy refer exclusively to the acute primary entero-colitis. No account will be taken of catarrhal diarrhœas or simple diarrhœa, such as rapidly disappear under the use of simple remedies, nor shall I include in my statistics all the cases observed by me in the course of my thirteen years' practice, but only those that I have attended in 1891 and 1892, all of which have been carefully examined and analyzed with the aid of previous experience acquired in the observation of infantile diseases. Before proceeding any farther I must observe that, not occupying any official post in the public institutions where sick children are admitted, the corroboration of pathological anatomy will be wanting in my observations, owing to the insurmountable difficulties in the way of obtaining autopsies in private practice. This paper must therefore be understood to be written only from an etiological, clinical, and therapeutic point of view.

My cases from a total of 155 children attended with acute primary enteritis during the period of first dentition. They are distributed as follows: Boys, 93; girls, 62; total, 155. Brought up entirely or partially on the bottle, 114; brought up entirely on mother's milk, 41; total, 155. Twenty-five of the former (21.93 per cent) and 3 of the latter (7.32 per cent) died. Total of deaths, 28, equivalent to 18.05 per cent. The same cases, classified according to the age at which the disease was contracted, give the following order:

Age.	Cases.	Deaths.	Mortality.
			Per cent.
1 month	11	1	
2 months	11	3	
3 months	16	4	25
4 months	15	5	
5 months	11	4	
6 months	11	2	
7 months	6	1	
8 months	7	2	
9 months	11	0	9
10 months	6	0	
11 months	4	0	
12 months	9	1	
Second year *	37	5	13.51
Total	155	28	

* Almost all the cases here included in a single group occurred between the twelfth and fifteenth months.

The 155 cases distributed according to the months in which they occurred appear in the following order:

January	13	August	16
February	15	September	4
March	16	October	5
April	15	November	13
May	11	December	10
June	21		
July	16	Total	155

Classified according to the form of the disease, they consisted of—

	Cases.	Mortality.
		Per cent.
Types:		
Cholera infantum	12	66
Acute entero-colitis	143	13.99
Total	155	
Forms of the entero-colitis:		
Common	68	5.88
Thoracic	25	7.69
Cerebral	22	22.72
Typhoid	4	15
Choleraic	23	26.08
Total	143	

Etiology and nature of the disease.—The following causes are reckoned among those that most commonly bring about the acute infantile enteritis in Havana: (1) Exposure to cold; (2) premature weaning; (3) indiscriminate use of cow's milk in the feeding of infants; (4) the use of food not adapted to the child's age; (5) the effect of high temperatures during the summer months, which is also our rainy season; (6) various infectious influences which habitually prevail in this locality. These various etiological conditions generally combine in many ways to produce the intestinal troubles. Most of them, however, only deserve to be considered as occasional factors, modern investigations having conclusively demonstrated the important rôle that belongs to infection as the primordial pathogenic agent in these diseases.

(1) Children are quite as liable to catch cold among us as they are in cold climates. The special construction of our houses, the constant breeze which prevails during the hot season, the common habit of opening doors and windows to mitigate the oppressive heat, the sudden fall of temperature after heavy showers, are frequent occasions of catching cold for the children of this country, generally very lightly

dressed, especially when suddenly exposed to drafts after awaking from their sleep, or after taking their milk, which frequently provokes perspiration.

(2) Premature weaning must also be considered as one of the predisposing causes of enteritis. The bad conditions of many of our wet nurses, their ignorance or low social grade, etc., induce many mothers to wean their children prematurely, thereby exposing them to the dangers of the following etiological agencies:

(3) The expenditure of cow's milk to the public is carried on under the most deplorable conditions for the feeding of infants. The rules of sanitary police are utterly disregarded. The cows, mostly attenuated or diseased, insufficiently fed, or supplied with a bad quality of pasturage, are led through the streets of Havana, frequently lying down, so that their udders come in contact with a soil infected to the highest degree with organic detritus of all kinds. The consequence is that even when milked before the very eyes of the consumer the milk is liable to be contaminated with pathogenic germs, putting aside the readiness of the milkman to adulterate the article by the addition of large quantities of water, in which Dr. Davalos has bacteriologically demonstrated the presence of various microbes, and in particular of the bacillus coli communis, so well known for its pathogenic properties. As to the milk which is sold in coffee-houses, milk depots, etc., it is often brought from considerable distances, and consequently delivered many hours after it has been milked. It is conveyed in tin cans so constructed that they can not be thoroughly cleansed, being greatly shaken before reaching its destination, and, moreover, adulterated, to say the least, with impure water, such as until the present year has been drunk in this city. All the above circumstances combine to produce the fermentations so well studied among us by Dr. Delfin, author of several important papers on that subject. In one of them* our colleague has called attention to the frequency and death rate of cholera infantum and to the fermentations developed in the milk under the influence of our high summer temperatures. If in addition to all these circumstances we take into account the carelessness with which artificial lactation is carried on in the households of Havana, the importance of this factor in the development of infantile diarrhœa will be readily understood.

Many of my colleagues have come to identical conclusions. Drs. Madan and Garcia Rijo,† in particular, have carefully studied the etiological influence just pointed out.

The best testimony that I can adduce to prove the dangers of lactation carried out under such unfavorable conditions is the fact that in the course of my thirteen years' practice I have only met with a comparatively small number of cases of enteritis among children exclusively fed from mother's milk, and such cases as did occur have afforded a more favorable termination (a mortality between 5 and 7 per cent).

(4) The use of improper food, of indigestible substances, of sweetmeats made with milk, cheese, ice cream, fruit, and other delicacies too early granted to children, have been in many of the cases observed by me the occasioned cause either of severe enteritis or of the clinical syndroms known as "cholera infantum."

(5) The injurious influence of heat is very remarkable in Havana, and has long since been pointed out. Even in the cooler season from December to March, when the average temperature ranges between 61° and 68°, there are days when the thermometer rises as high as 82° or 86°, and the enteritis is again observed. In midsummer the temperature rises as high as 90°, 93°, and 97°, the number of intestinal disorders increasing with the intensity of the heat, as shown in the tables of comparative mortality for the period 1888–1892, given further on.

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* La Leche en la Habana (Primer Congreso Medico Regional), p. 481. Habana, 1890.

† Garcia Rijo. Apuntes clinicos sobre el envenenamiento por la leche en los recien-nacidos y fiebres de la la infancia (Primer Congreso Medico Regional, p. 212. Habana, 1890). Madan. Consideraciones sobre las diarreas graves dela primear infancia (Cron. Med. Quirung.) Tomo i 6, p. 476 y 545. Habana, 1890.

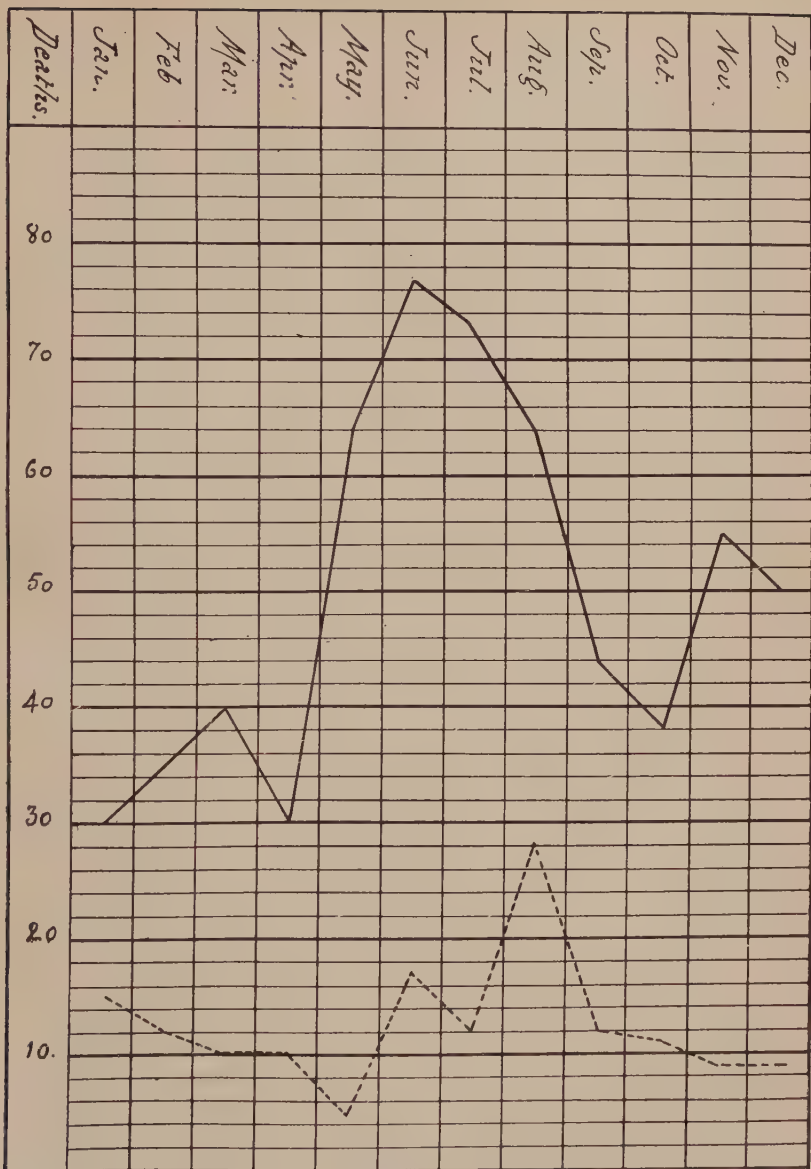
The 155 cases noted down in my own case book for the two years of 1891 and 1892 present the following monthly distribution:

January	13	July	16
February	15	August	16
March	16	September	4
April	15	October	5
May	11	November	13
June	21	December	10

The highest morbidity corresponds to the months of June, July, and August, and it is particularly to be noticed that in the months of March and November, which are frequently warm, a corresponding increase occurs in the number of cases, a fact also observed in the general demographic statistics for the years mentioned above. Inasmuch as the summer heat by itself can not be regarded as capable of producing the diarrhœa, I shall consider in the next paragraph what seems a plausible explanation of the anomalies offered by the curve of morbidity and mortality.

(6) Three infectious diseases, which prevail endemically or epidemically in Havana, deserve to be particularly considered, owing to their primary localizations in the intestinal tract. They are typhoid fever, paludism, and grippe. There is besides, a numerous group of fevers, not yet etiologically classified, which may for the present be included, so far as their clinical features are concerned, among the typhoid fevers. They constitute toxi-infections originated in the intestinal tract, bearing great resemblance to the incomplete forms of typhoid fever, their duration being more or less prolonged and likely to be modified by the appropriate employment of purgatives and intestinal antiseptics in their treatment. The etiological conditions that preside over the development of all these fevers are to be sought partly in the composition of the soil, in the quality of our water supply, such as it has been until last year, and also in the well-known disregard of everything appertaining to public hygiene. The collection of garbage is very deficient; the streets are badly paved, and in main wards not properly swept, whereby infectious foci of every kind are formed all over the city during the rainy season. The sewerage is as bad as can be; it is not carried out on a general system, but only consists of very poor drains, deficient in size, declivity, and workmanship, and scarcely calculated to prevent the filtration or accumulation of corrupt matter in the soil of the city. In addition to this a most defective system of cesspools is used in our houses, and the municipal ordinances are often infringed, the privies being surreptitiously connected with the sewers which run along our streets. From this it will be readily understood that the muddy soil of Havana, lying as it does upon an impermeable subsoil, must be completely saturated with infection. According to the calculations of our engineers, Messrs. Gonzalez and Amigó, every year 79,200,000 kilograms of fecal matters find their way into the soil around the cesspools and sewers. It is no wonder, therefore, that in a dense city like ours, where all the etiological elements favorable to organic decomposition are present, heat and moisture in particular, the air should be greatly contaminated with impurities, and charged with deleterious effluvia and microbes which being deposited on the walls of the pharynx, are afterwards swallowed with the food and drink, thereby producing many kinds of infection in the intestinal canal. All that Dr. Lewis Smith has written in his book on Diseases of Infancy regarding the causes of enteritis is verified in Havana upon an enlarged scale, and if the results have not been worse it is undoubtedly due to the influence of the winds which constantly purify our atmosphere, and to the copious rains that wash out our imperfect sewers.

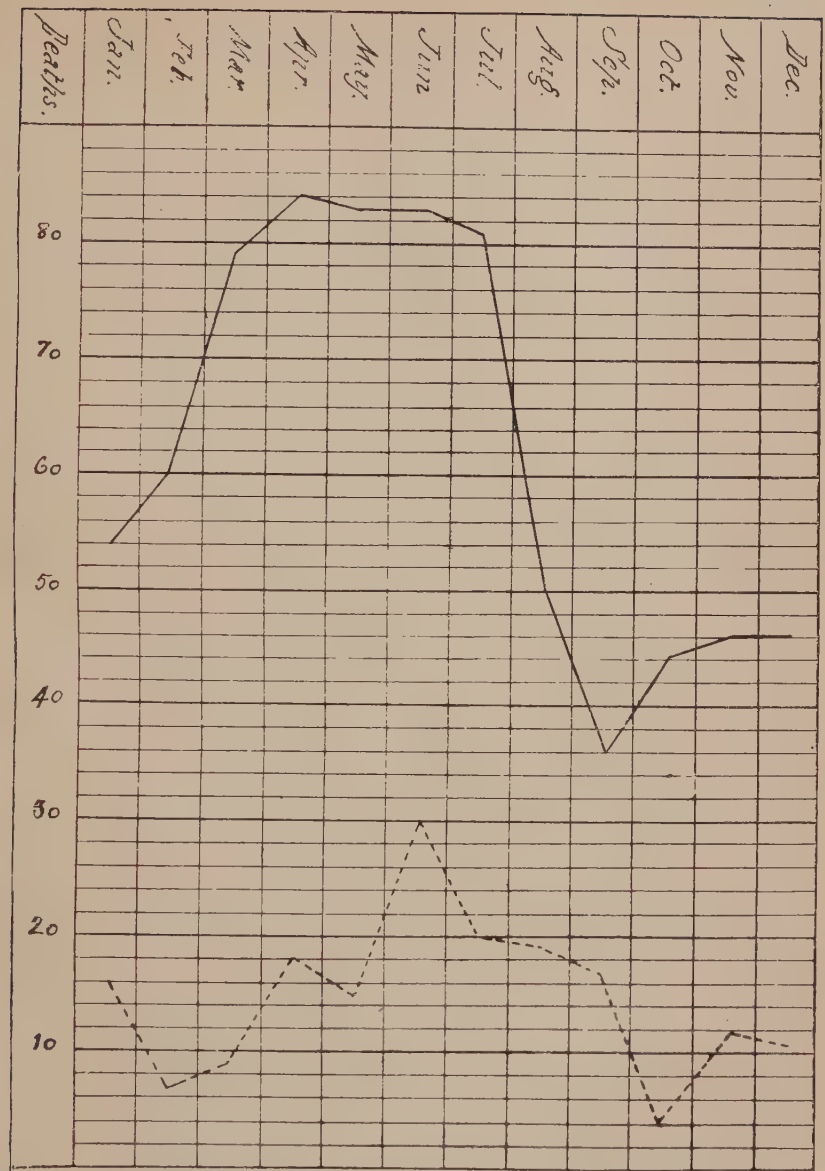
The etiological conditions already described affect all the inhabitants of the city, but as will be readily understood, their influence is more disastrous upon infants, principally upon those that are badly lodged and improperly fed. In more advanced childhood, in youths, and even in adults, the infection is apt to assume another



---------- Deaths from typhoid fever at all ages during the year 1888.

———— Deaths from enteritis at all ages during the same year.

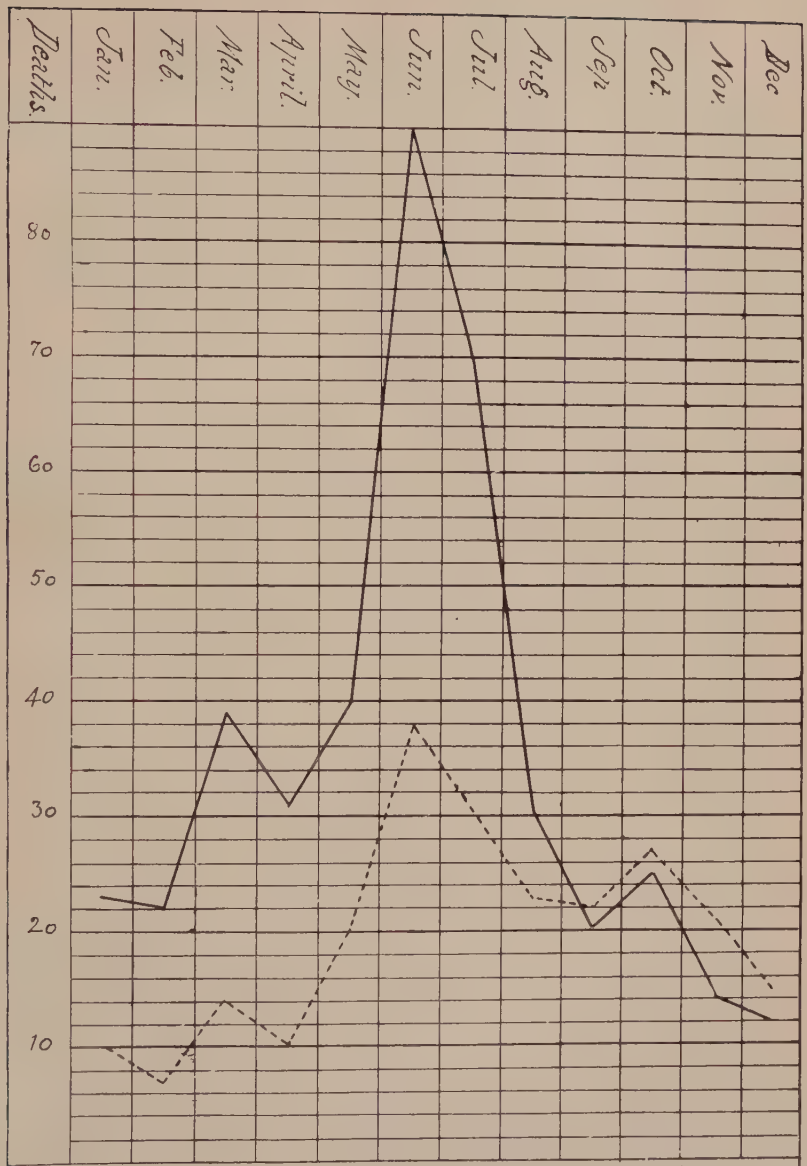
The statistics for that year do not give the deaths rate according to ages, so that no distinction can be made between adults and infants.



--------- Deaths from typhoid fever at all ages during the year 1889.

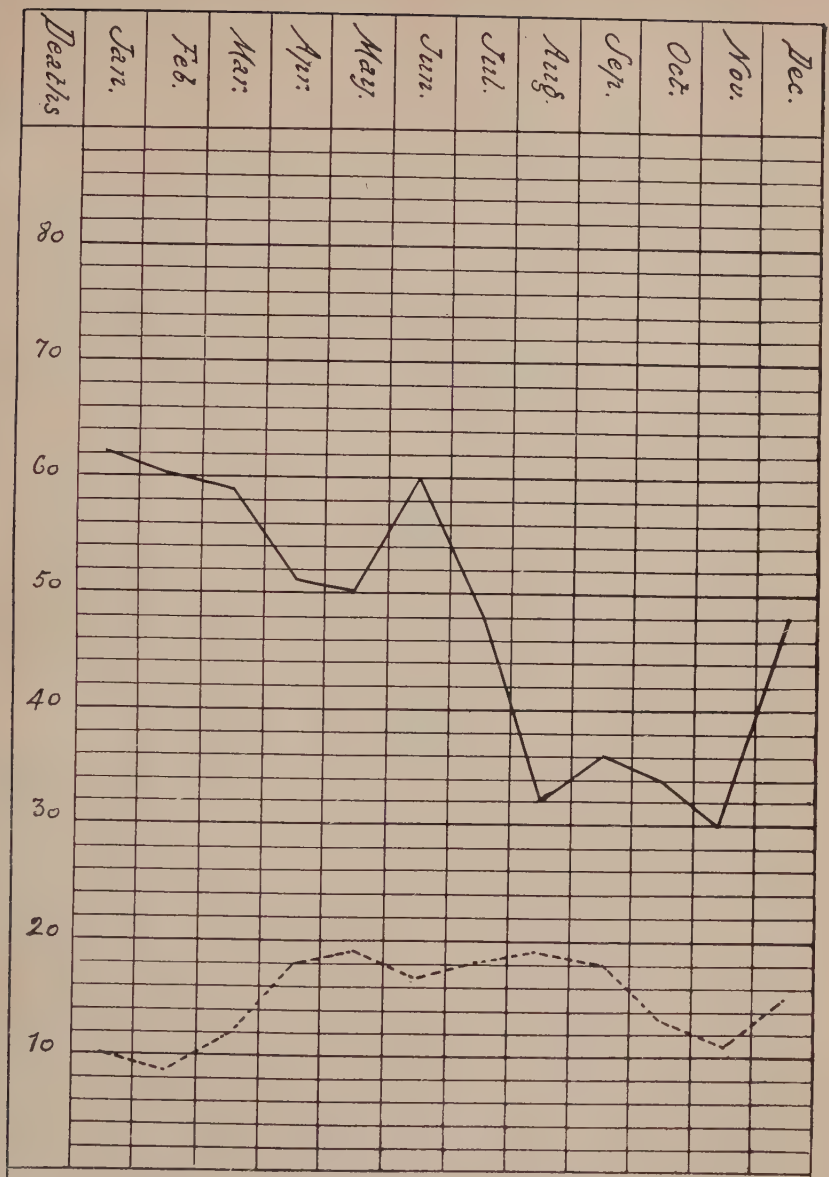
——— Deaths from enteritis at all ages during the same year.

The statistic for that year do not give the deaths rate according to ages, so that no distinction can be made between adults and infants.



--------- Deaths from typhoid fever at all ages during the year 1890.

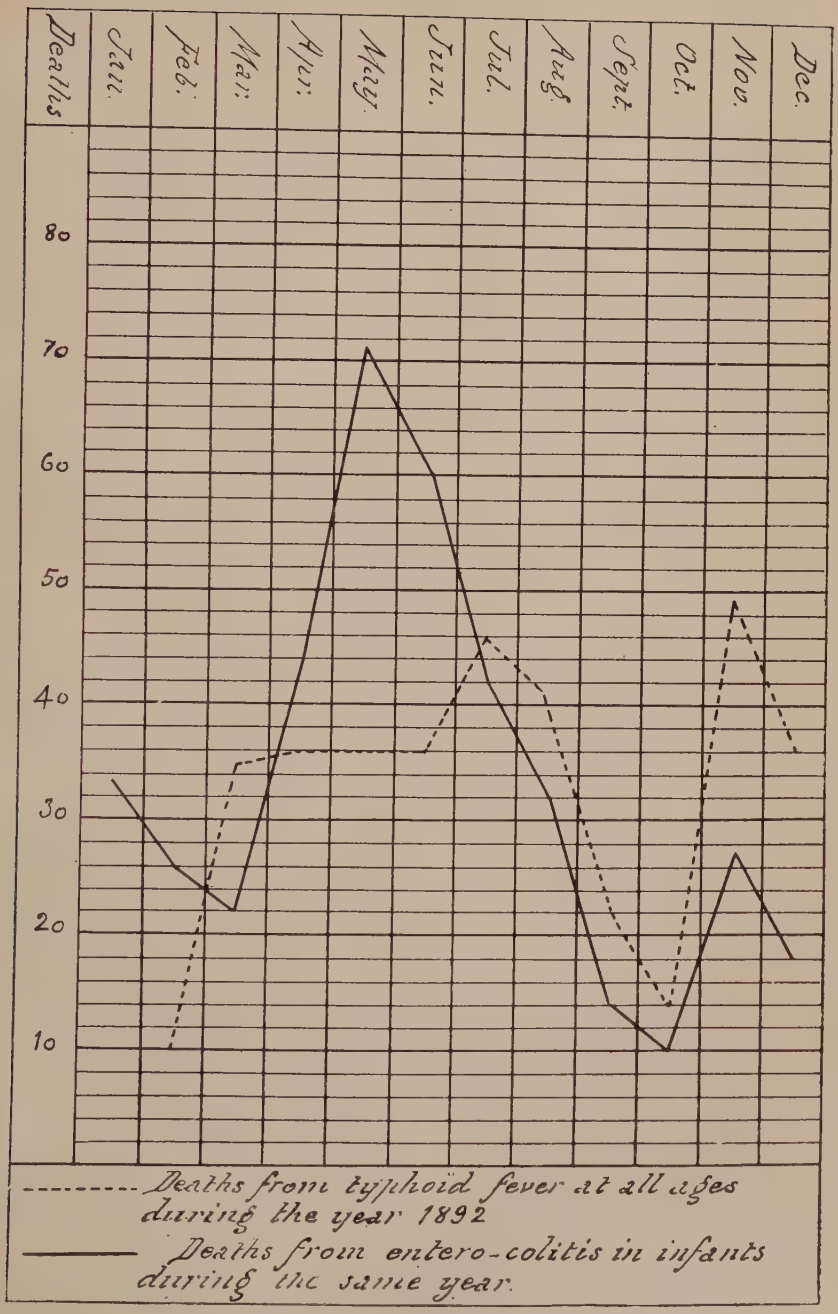
——— Deaths from entero-colitis in infants during the same year.

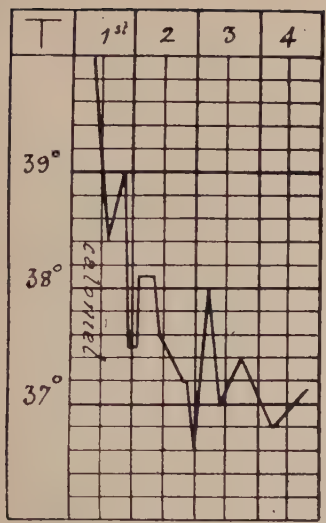


-------- Deaths from typhoid fever at all ages during the year 1891.

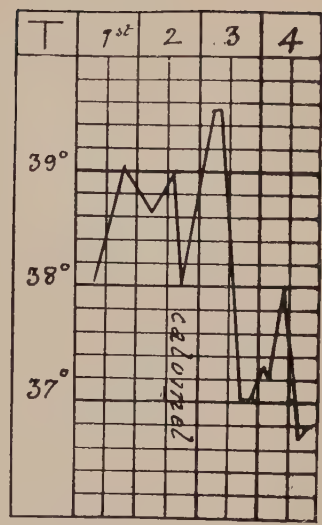
——— Deaths from entero-colitis in infants during the same year.

In this chart a relation between the two curves apparent. The cases of typhoid fever were milder and less numerous than usual.

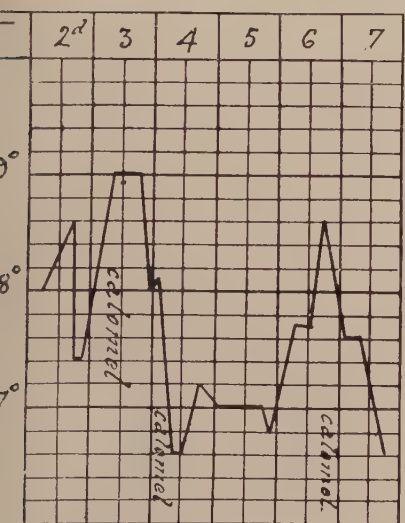

Deaths
Jan.
Feb.
Mar.
Apr.
May.
June.
Jul.
Aug.
Sept.
Oct.
Nov.
Dec.
80
70
60
50
40
30
20
10
Deaths from typhoid fever at all ages during the year 1892
Deaths from entero-colitis in infants during the same year.



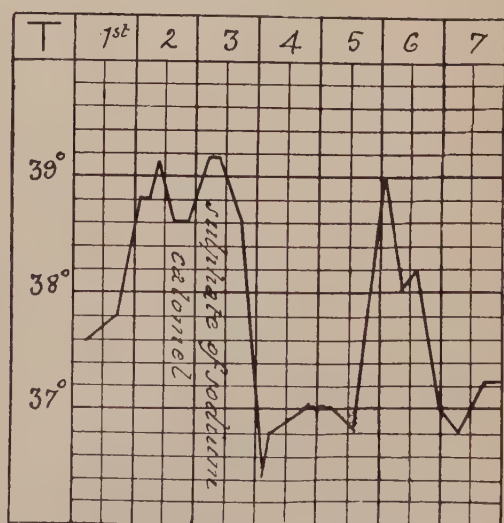
6. Enteritis in a girl 15 months old.



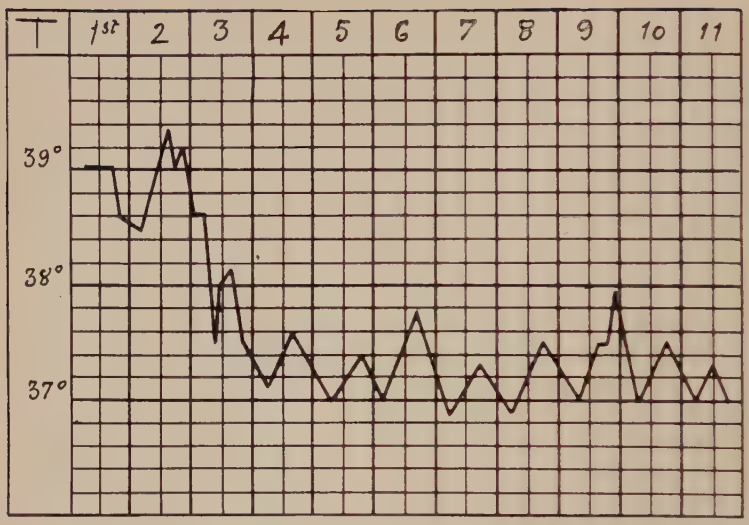
7. Intestinal infection in a girl 4 years old.



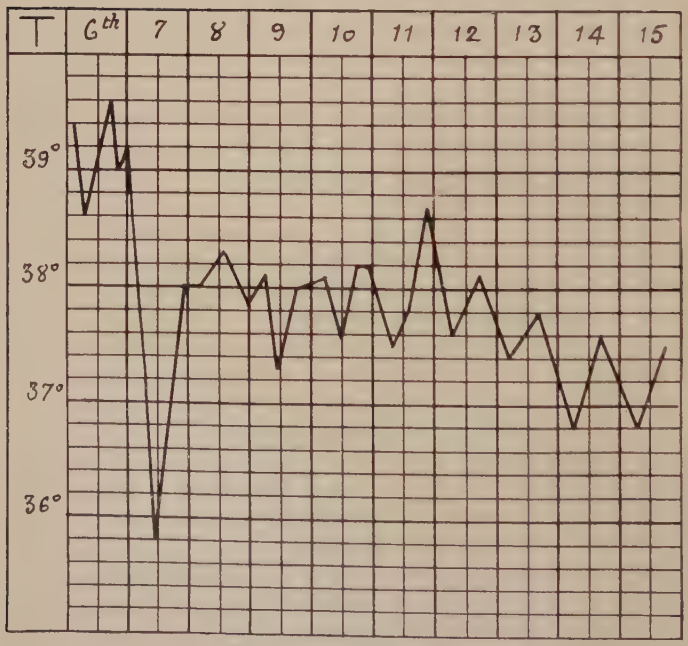
8. Relapsing enteritis in a boy 5 months old.



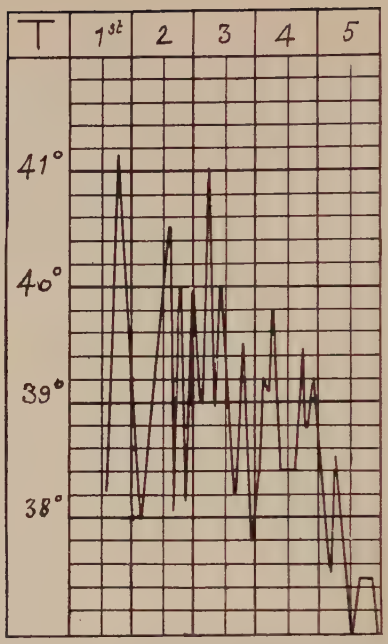
9. Gastro-intestinal fever in a boy 6 years old.



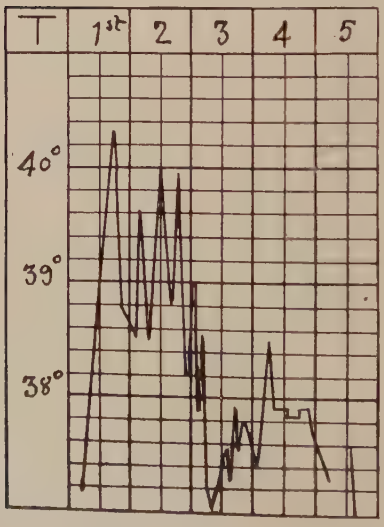
10. Enteritis in a girl 4 months old.



11. Intestinal infection in a girl 14 years old.



12. Paroxysmal type. Enteritis of comatose form in a child 7 months old.



13. Intestinal infection in a girl 4 years old.

clinical character, so that the prevalence of infantile enteritis often coincides with the intestinal fevers already spoken of, and with cases of regular typhoid, all of which pathological conditions obtain a common source of development in the multiple factors already mentioned. In support of this assertion I need only call attention to the relation between the monthly mortality from entero-colitis of infancy and that from typhoid fever during the years 1888–1892. The agreement between the two curves would be still greater if all our physicians adopted an identical criterion. Notwithstanding the discrepancies regarding the classification of diseases, the parallelism between the mortality curves of those infections is sufficiently apparent, but it is even more so from a clinical point of view when we consider the distribution of both diseases inwards, presenting similar hygienic conditions (Figs. 1, 2, 3, 4, 5, 5 bis.)

It will be readily seen that in the years in which typhoid fever prevailed the cases of entero-colitis were more frequent and more severe. The month of June has nearly always presented the highest mortality; the latter varies in different years during the months of July, August, and September, decreasing considerably in this last month. To the months of March and November corresponds sometimes an increase in the number of cases and deaths, which may be attributed to several conditions either of a general or local character, among which may be mentioned, besides the atmospheric temperature, the prolonged dryness of the first months of the year; the retention of fæcal matter in the sewers; the defective construction of some dwellings; perhaps also the greater virulence acquired by the pathogenic germs in some districts, and the propagation of morbific foci through which a revival of the infection is effected.

Let us now compare these two series of tracings, the first corresponding to entero-colitis free from choleriform symptoms, the second to fevers such as have already been spoken of in older subjects. A remarkable similarity will be observed in the temperature curves of both series, so much so that when other characters common to both morbid conditions are considered with respect to their symptomatology, course, and prognosis one is inclined to believe that they belong to the same class of diseases (Figs. 6, 7, 8, 9, 10, 11, 12, 13).

The bacteriological investigations to which the fæcal matters proceeding from my little patients have been submitted were accomplished by my learned friend, Dr. Dávalos, at the Laboratorio de la Crónica Médico Quirúrgica. His exhaustive work confirms once more the results obtained in similar cases by other bacteriologists in different countries—such as Emmert Holt, Escherich, Baginsky, Lesage, and Macaigne. In all my cases Dr. Dávalos has found bacteria of different species; the habitual saprophytes of the intestinal canal, the baccillus subtilis, the B. termo, staphylococcus pyogenes aureus, but principally the bacillus coli comunis, which, through its soluble products, determines the secondary phenomena of toxi-infection when they are not transformed in the liver and favorably eliminated through the renal filter. (Gilbert.)

Besides these infectious causes, which are the most prevalent and have been more particularly studied, paludism and grippe are sufficiently common in Havana to provoke in small children cases of acute primary enteritis, with symptoms that can not always be differentiated from those of the other species previously mentioned. In such cases an etiological diagnosis can only be obtained by inquiring deeply into every particular and calling to our aid all the resources of general and clinical observation. It is, then, necessary to study the media and other conditions surrounding the sick. The malarial enteritis generally coincides with the appearance of correctly diagnosed malarial fevers. It is found to occupy the same foci, and may be differentiated by a thorough etiological inquiry, by a proper examination of the blood, by the organic lesions which malaria leaves behind, by its tendercy to reappear under one or other of its forms, or by the readiness with which its various manifestations subside under the use of quinine. In doubtful cases it is necessary to be very cau-

tious in the etiological diagnosis and in the employment of medicines founded thereon, for errors, one way or the other, may have fatal consequences for the little patient.

The grippe enteritis coincides with the endemic grippe and recurs with the latter in certain seasons of the year. It is generally observed in families where other of the many clinical forms of grippe are simultaneously developed, or as instances of subsequent propagation; and, excepting some special cases, its true nature can almost always be correctly established.

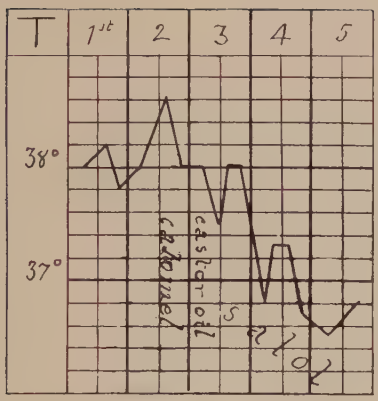
Clinical considerations.—All my cases can be grouped under the two headings:

	Cases.	Mortality.
		Per cent.
Cholera infantum	12	66
Acute entero-colitis	143	13.99
Total	155	

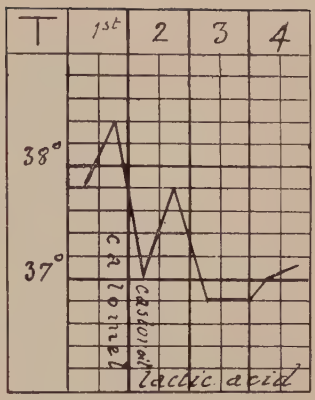
I shall only discuss the second group, which, besides being more frequent, offers greater clinical varieties, and is more open to doubt where etiology, diagnosis, prognosis, and treatment are concerned. Cholera infantum, on the other hand, is more regular in its manifestations and its treatment, though often unsuccessful, is less subject to discussion.

The more frequent forms of infantile entero-colitis observed in Havana are the common form described by authors, the thoracic and the cerebral: the gastric, remittent, dysenteric, typhoid, and choleraic forms being also occasonally met with. The common form of the disease is generally preceded by intestinal disturbances, to which little importance is given. More rarely it breaks out suddenly, in which case the fever, which, as a rule, comes out at night, generally precedes the diarrhœa, and the course of the morbid process is not so much that of an enteritis as of an infection originating in the intestine. Whatever the beginning may have been, the cases may be classified in three groups: light, moderate, and severe. In the first group the abdominal symptoms are moderate and the general phenomena variable, but of mild intensity. I shall not insist on the number or characters of the evacuations, my principal object being to present a brief outline of the morbid process as a whole. The temperature ranges between 99.5° and 101.5° F., or little more, during the febrile stage, which lasts from two to five days. The intestines are somewhat more tardy in recovering their normal functions. Relapses are frequent. (See the adjoining charts, Figs. 14, 15, 16, 17, 18, 19.)

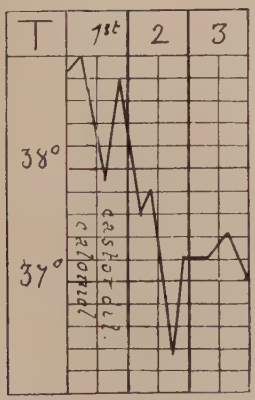
In the second group the symptoms are more marked, but not all in the same degree. Some of the general phenomena acquire greater intensity. Restlessness, excitement, insomnia, and moaning are observed. The tongue is coated; there is anorexia, thirst, nausea, and sometimes vomiting. The abdomen is more or less sensitive to the touch in the region of the small intestines or in that of the ascending and transverse colon. The character of the evacuations varies considerably. The fever is of a subcontinuous type during the first days, afterwards becoming remittent, and then gradually decreasing as the local phenomena subside. In other cases it is remittent from the beginning, and even intermittent, from which it must not be inferred that it is malarial, for all these types have been pointed out by observers who practiced in cities where malaria did not prevail. Recent investigations have, moreover, brought to light the pyretogenous properties developed by microbial toxines through the nervous system. Finally, it is not uncommon to observe a persistence of thermic oscillations after the evacuations have recovered their normal appearance, thereby showing the infectious character of the disease. Calomel and antiseptics rapidly control the thermic disturbance. If this be not attained, the etiological conditions must be further investigated and the resulting indications opportunely acted upon. The duration of these cases of moderate intensity varies between one and two



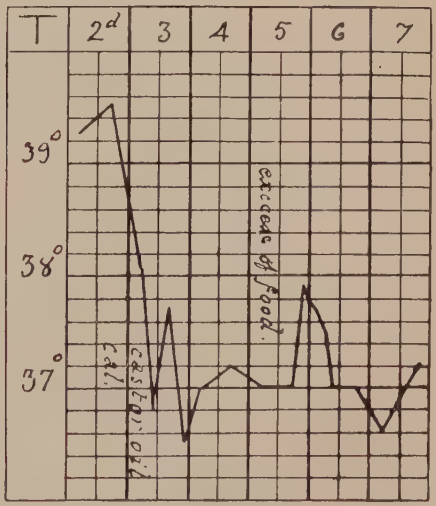
14. Three months. Mother's milk.



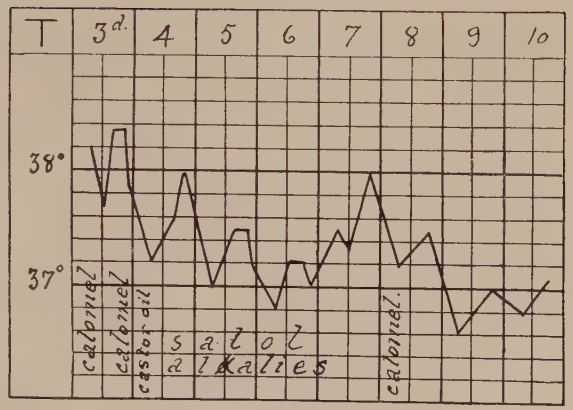
15. Three months. Mother's milk.



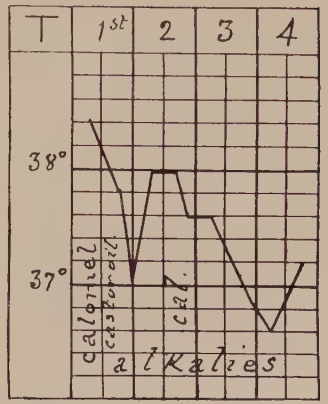
16. Five months. Mixed milk diet.



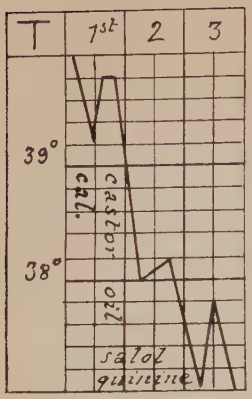
17. Four months. Mixed milk diet.



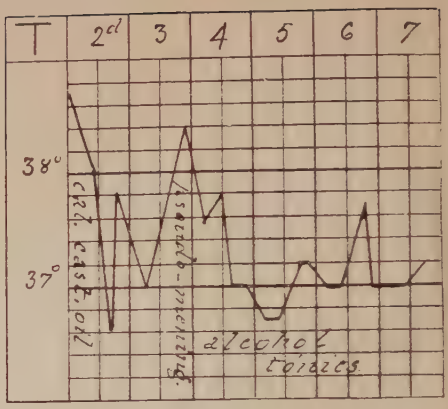
18. Thirteen months. Mixed diet.



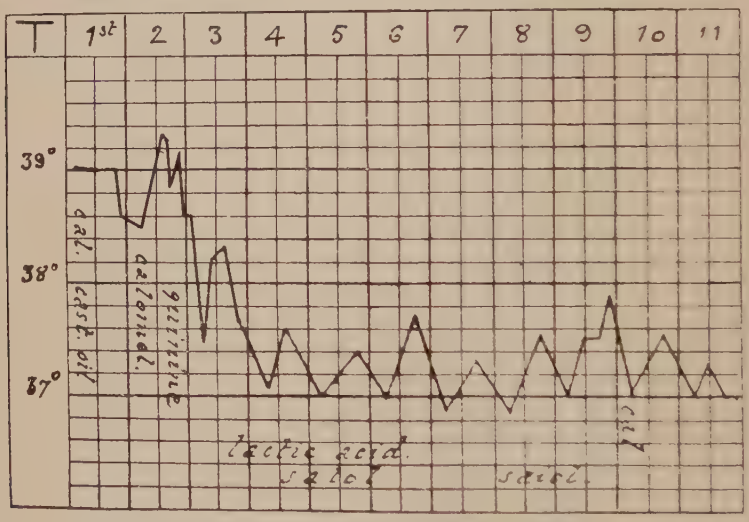
19. Six months. Milk from the bottle.



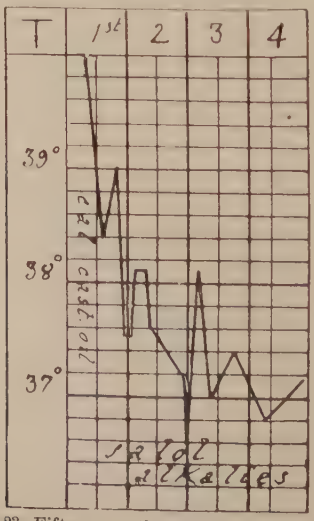
20. Seven months. Milk from the bottle.



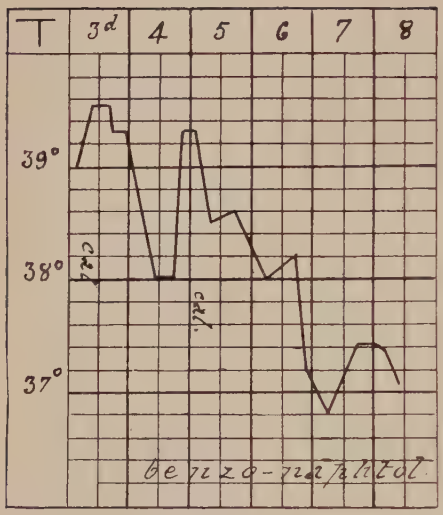
21. Two months. Mixed milk diet.



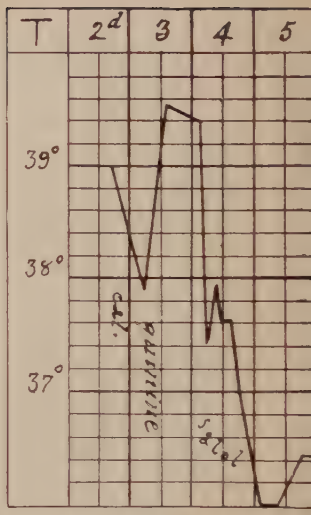
22. Four months. Ill-chosen wet nurse. Grippe.



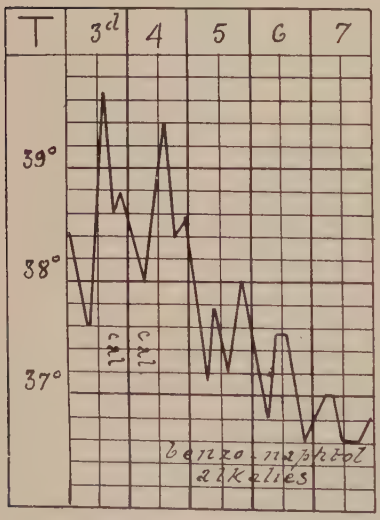
23. Fifteen months. Mother's milk.



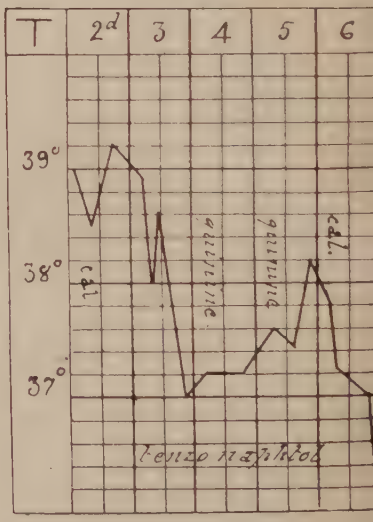
24. Seven months. Milk from the bottle.



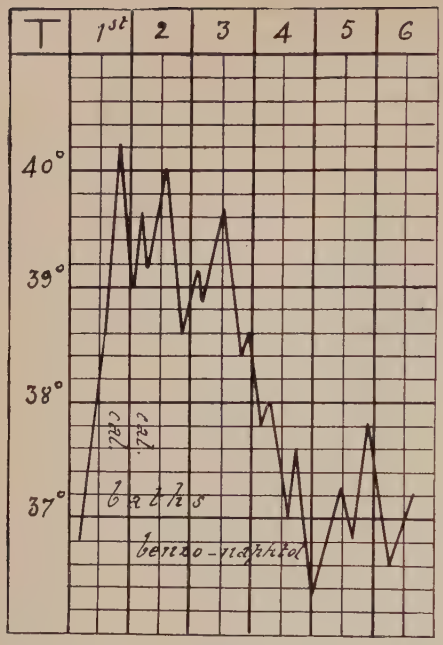
25. Eight months. Milk from the bottle.



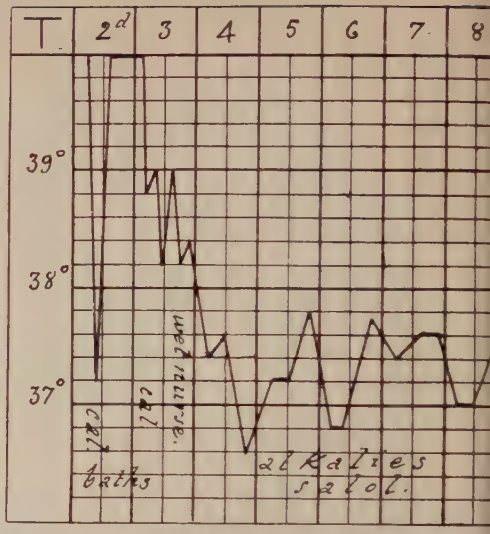
26. Twelve months. Mixed diet.



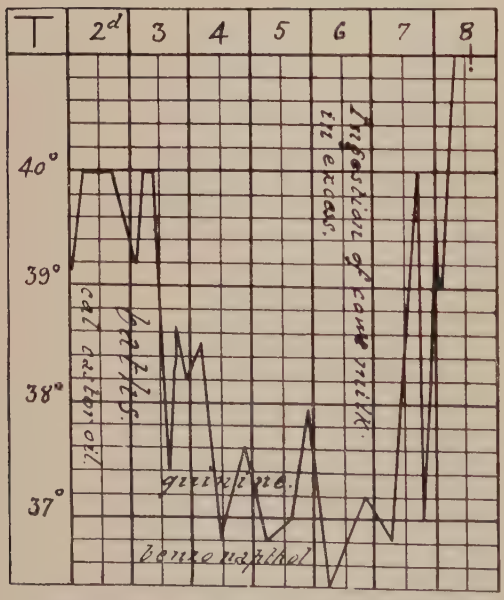
27. Thirteen months. Mixed diet.



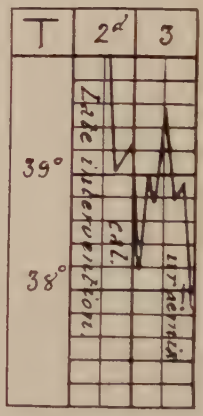
28. Seven months. Milk from the bottle. Comatose form.



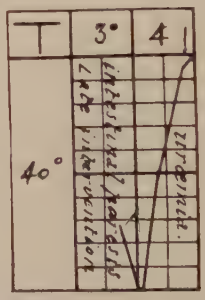
29. Three months. Milk from the bottle. Convulsive for



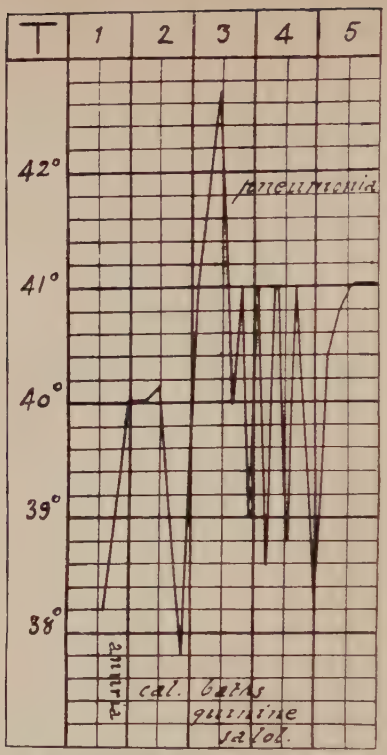
30. Nine months. Milk from the bottle. Comatose form.



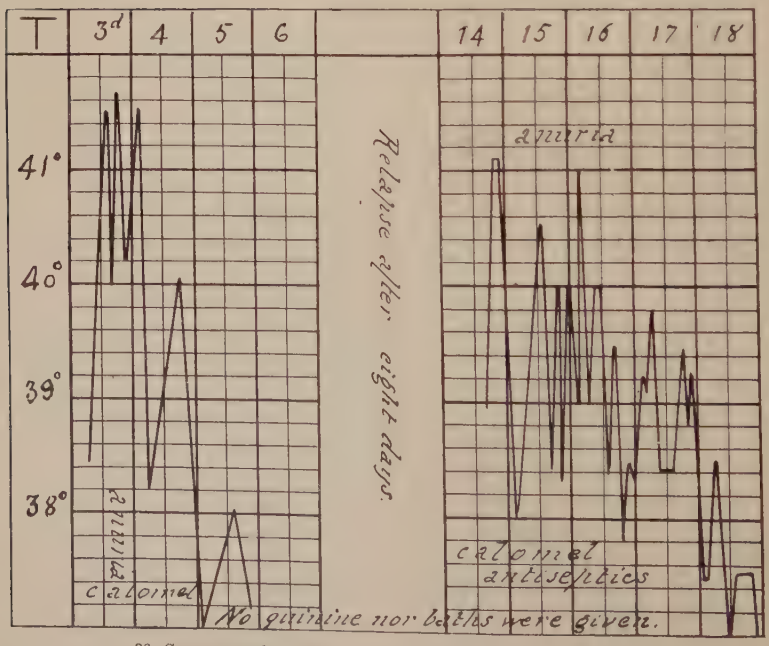
31. Thirteen months. Mixed diet. Eclamptic form.



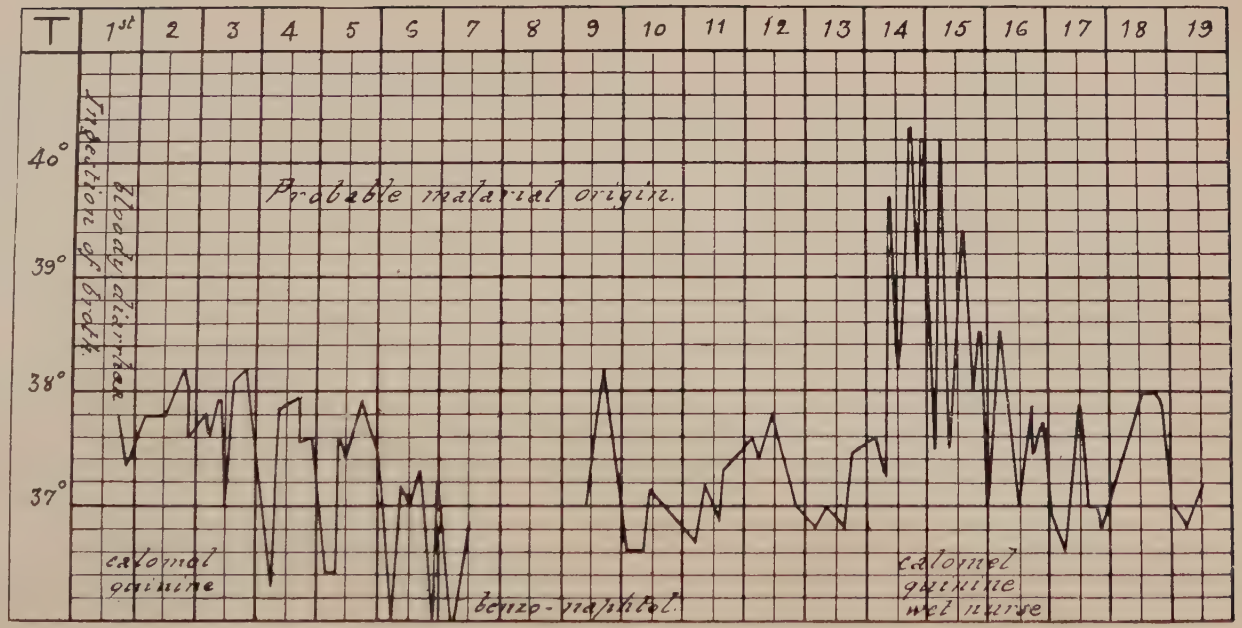
32. Thirteen months. Milk from the bottle. Tetanic form.



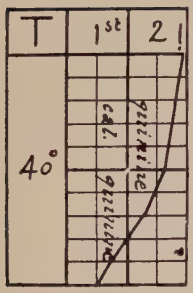
35. Two months. Milk from the bottle. Comatose form. Vomiting and diarrhea during two days.



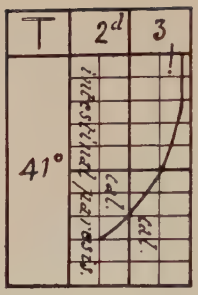
36. Seven months. Milk from the bottle. Comatose form.



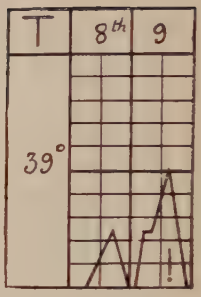
37. Ten months. Habitual dyspepsia. Milk from the bottle. Nestle's food.



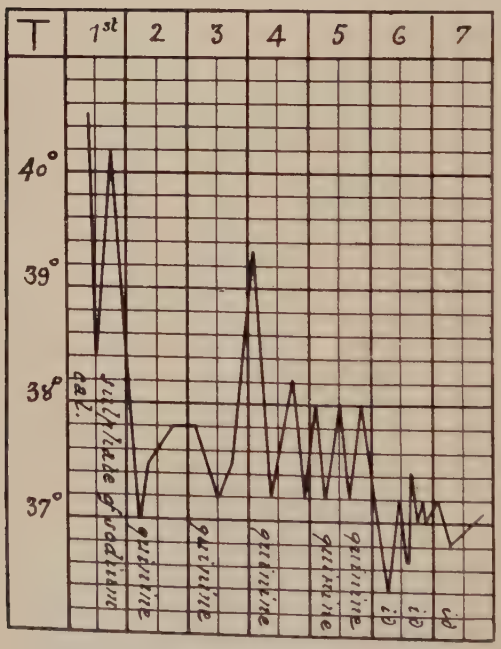
38. Five months. Milk from the bottle. Choleraic form. Malarial origin.



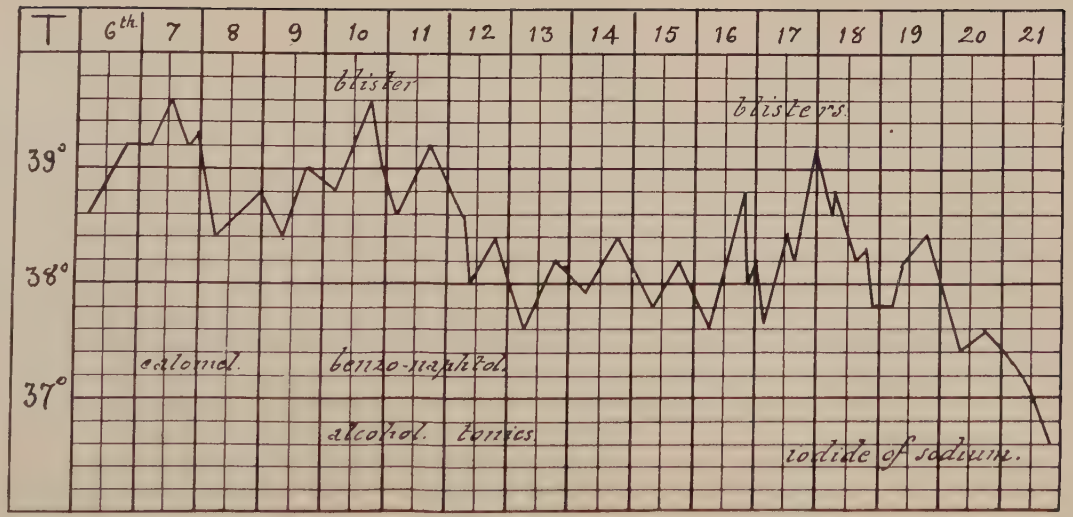
39. Eight months. Milk from the bottle. Eclamptic form.



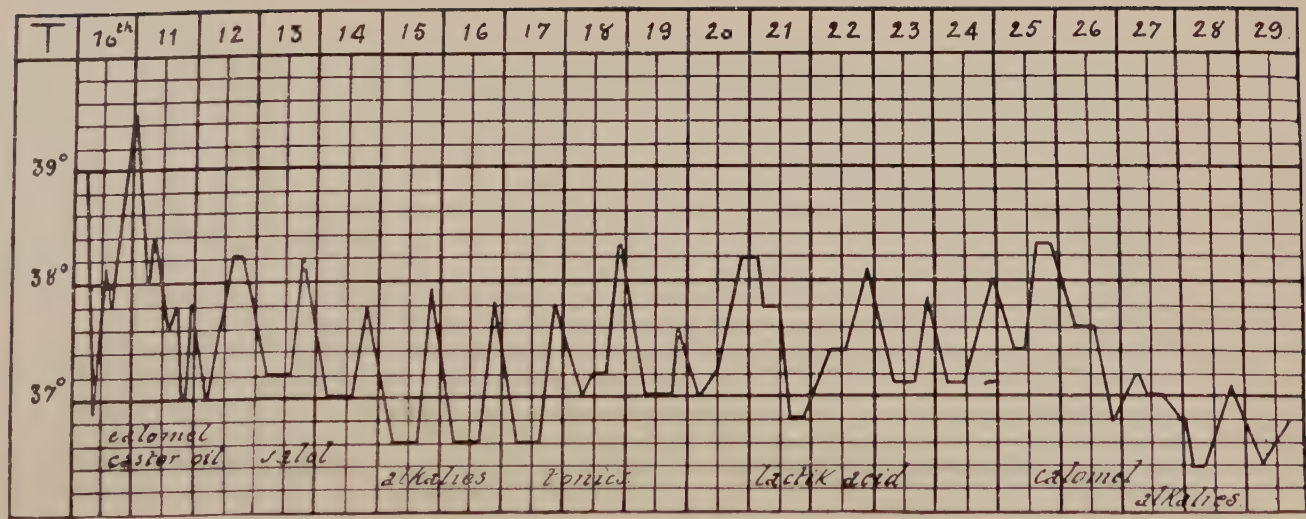
40. Four months. Milk from the bottle. Choleraic form. Same patient referred to in fig. 43.



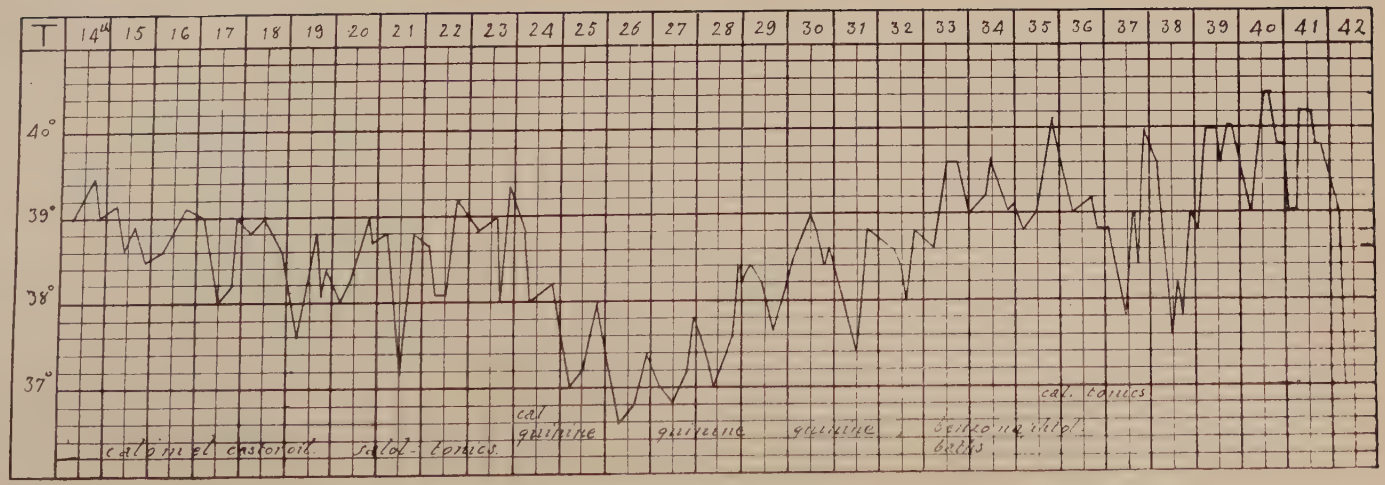
41. Girl 5 years old affected with malaria in the same house and at the same time as the child referred to in fig. 38.



42. Eight months. Milk from the bottle. Thoracic form. Broncho-pneumonia.



43. Boy 2 months old. Hereditary syphilis. Milk from the bottle. Remittent form.



44. Three months. Mixed milk diet. Typhoid form. Bacillus coli commune. Staphilococcus pyogenus aureus.

weeks, which may be prolonged in an apyrectic condition over three or more weeks, subject in a great measure to the influence of the dietetic plan that has been adopted. (See the adjoining charts, Figs. 20, 21, 22, 23, 24, 25, 26, 27.)

In the group of severe cases the symptoms are either more alarming from the onset or else they become so during the course of one or other of the forms already described. The predominance of cerebral phenomena justified the different names given to these cases by some authors: eclamptic, convulsive, comatose, meningitic, or pseudo-meningitic. The intensity of these symptoms may be such as to carry off the little patient within a short time if he proves unable to withstand the infection; but they can often be checked provided opportune and energetic measures are at once taken. If so, the severe symptoms gradually subside and, other complications being prevented, the fever ceases and the child is soon restored to health. But this is not always the case. The infection may return with renewed force, and after an interval of comparative calm the dangerous symptoms break out again, attended with an elevation of the central temperature, with coldness of the extremities, and scanty urine. If the discharges have been abundant or the child is of feeble constitution, pseudo-meningitis makes its appearance, with its well-known symptoms. In either case a fatal termination often occurs in spite of all our efforts. In other cases the bowels become paretic, probably owing to sapræmia, as Dr. San Martin has suggested. The consequences of this pathological complication are fearful; purgatives, massage, cold enemata, are unequal to the task of rapidly emptying the intestines; the toxines formed high up in the bowels soon invade "en masse" the infant's delicate organism, and within a few hours of the attack the child dies with all the phenomena of rapid uræmia. The thermic cycle of all these cases deserves to be known. Hyperpyretic accessions of subirritrant type, irregularities in the acme, simulating the course of pernicious malaria are observed, all of which will be readily understood by a glance over the adjoined charts, better indeed than from a verbal description (Figs. 28, 29, 30, 31, 32, 33, 34, 35, 36, 37).

Besides the symptoms properly appertaining to the enteritis, upon careful examination, and when there is but little tympanitis, a moderate amount of hepatic congestion may be discovered. In docile children the sharp edge of the liver may be felt by using the method of the nail, which occasions some degree of pain. I have found hepatic hyperæmia in many cases of acute enteritis, and I call attention to it, because it might be erroneously attributed to a malarial origin. Its occurrence need not surprise us if we remember that this organ attains its highest functional activity in early life and reckons among its attributes the elimination of the toxines elaborated by the intestinal microbes.

Regarding the gastric, choleraic, typhoid, and dysenteric forms, I have nothing to add to the complete descriptions of our text-books or to more recent contributions of renowned specialists, but shall merely present the adjoined temperature charts as obtained from my little patients (Figs. 38, 39, 40, 41, 42, 43, 44).

Before leaving the subject I shall describe some other types or varieties concerning which I possess complete notes.

The remittent type resembles the pyrexia of older children in its thermic cycle and in its duration, which fluctuates between two and four weeks. It is perhaps one of the clinical forms of B. coli infection which most demands to be distinguished from typhoid fever and from remittent malarial fever in accordance with the criterion presented in our chapter on etiology.

Finally, there is a very dangerous variety of infectious enteritis which surprises by its apparent benignity. After a few days of moderate diarrhœa of greenish color and fœtid smell, attended with emaciation and *malaise*, symptoms of gastric disturbance make their appearance, consisting of nausea, sometimes vomiting and spells of gastralgia, followed by intervals of relief, during which the expression of the face is somewhat apathetic. The abdomen is soft, depressible, and sensitive to pressure, no signs of visceral congestion are observed, the temperature continues normal at all hours, but there is persistent anuria. Suddenly the breathing becomes

irregular, the spell of gastric pain reappears, the face becomes livid, and the child dies quietly by asphyxia or after some slight convulsions in the extremities and with dilated pupils.

The thoracic form described by Sevestre and Lesage and subsequently by Gaston and Renard is pretty common in Havana, cases being observed of all grades of intensity from simple bronchitis to generalized broncho-pneumonia. When the course of the disease is prolonged and the child has a delicate constitution, tuberculosis may declare itself, as exemplified in Chart No. 45.

Treatment.—Leaving out cholera infantum, the treatment of acute enteritis must necessarily vary in each case according to its intensity, form, and nature; but the following principal indications must be borne in mind: (1) Relieve the intestinal canal of its contents; (2) procure an antiseptic condition and functional repose to the organ; (3) restore the wasted energy; (4) combat special symptoms and complications. Of course, whatever be the form of the disease, the essential point is to empty the bowels. The old purgative plan which was directed against one of the symptoms of enteritis has now a causal indication, through a better knowledge of the origin and pathogeny of the disease. Calomel, in doses of 5, 10, 20, 50 centigrams or more, according to cases, followed by castor oil, is the remedy that has given the best results. I am convinced that when the disease has followed an unfavorable course, notwithstanding its employment, it has been due to one of the following circumstances: Late intervention; persistent paresis of the intestine; extraordinary intensity of the infection. After obtaining the beneficial results of this antiseptic purgative, three indications have to be satisfied: To maintain the antisepsis of the intestines; to keep the organ in complete repose, and to restore the lost energies. Salol, salicylate of magnesia or bismuth, and benzo-naphthol are the agents that have given me more brilliant results, while hydric diet, which I have used since the beginning of my practice, realizes the two additional indications. The water should be boiled and given in small quantities at prudent intervals, either cool or iced, with or without the addition of rum or cognac. The duration of the hydric diet should not be continued beyond twenty-four or thirty-six hours as a maximum.

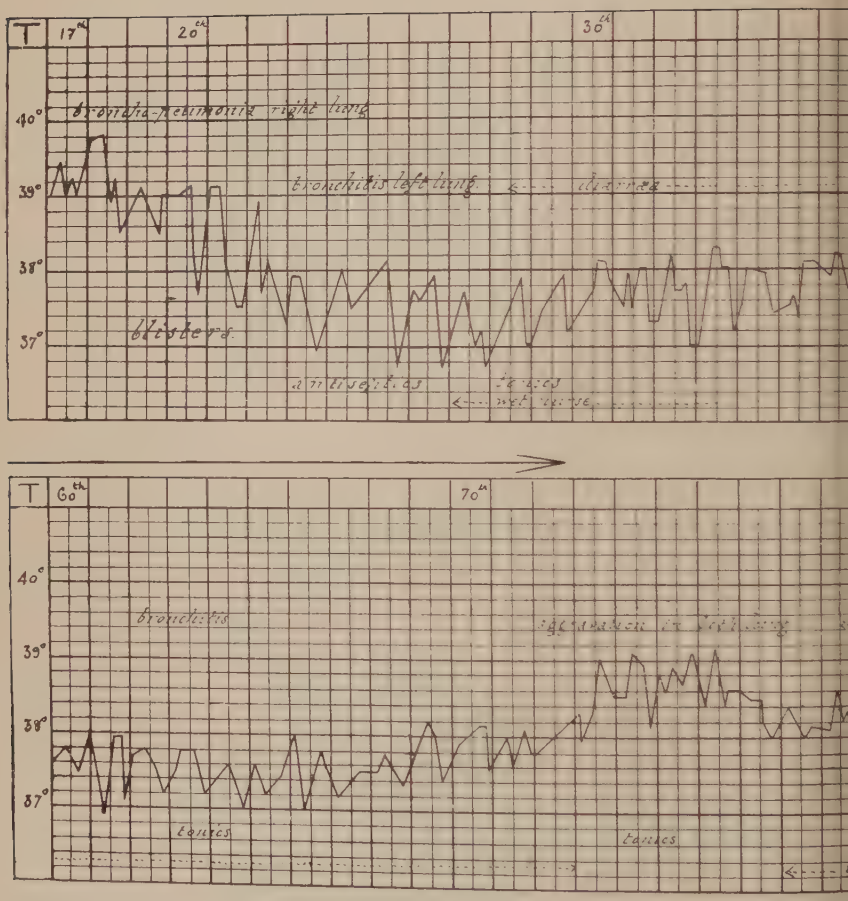
Other symptomatic or causal indications may be required to be attended to. So the employment of local emollients, of cold compresses, of cold, antiseptic enemata, of general baths, frictions, revulsives, massage, may be called for. The use of certain internal remedies, such as opium, alcohol, quinine, tonics, caffeine, acids, alkalines, etc., according to the form, period, nature, or complications of the disease, may contribute to improve the condition of the patient, for whom resources of all kinds may be needed before he can be restored to health. I have learned by experience that the persistence or aggravation of a symptom, or even the fatal termination of the disease, may depend on the omission or imperfect execution of some detail, on the doses and manner of administering some medicines, on the slightest negligence or forgetfulness in the attendance.

I consider the hygienic alimentation of capital importance in enteritis. The choice of a proper wet nurse is the best guarantee for his recovery. Failing this I give the preference to ass's milk, next to the condensed milk, and lastly to cow's milk (preferably sterilized). Whatever food be chosen, the technical precautions of lactation must be scrupulously observed, else the convalescence may be interrupted by relapses, which are always prejudicial to the child and not infrequently to the physician's reputation.

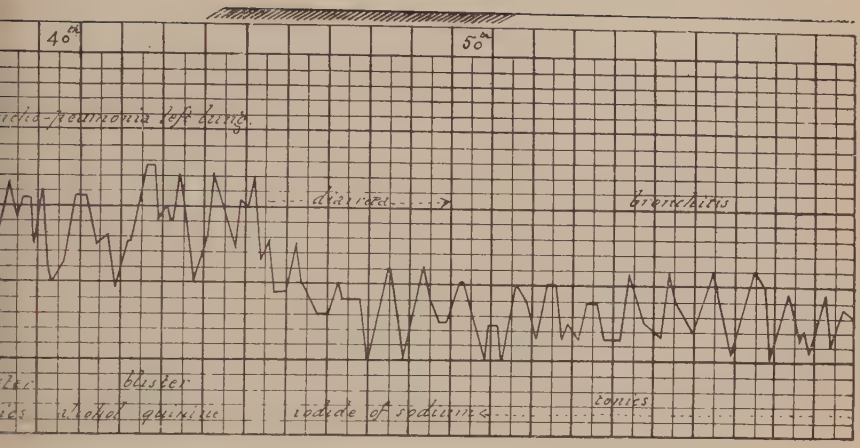
CONCLUSIONS.

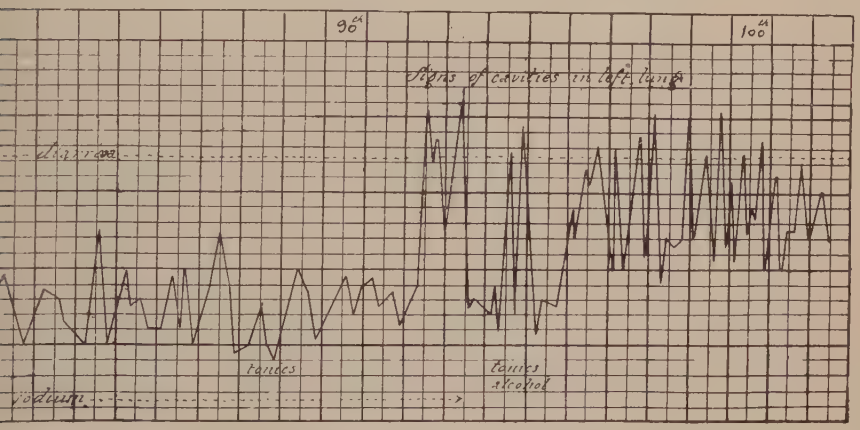
(1) Clinical observations and demographic statistics show that infantile entero-colitis, in all its forms, occurs in Havana with a death rate as high as that observed in other populous cities.

(2) The two principal types observed are cholera infantum and entero-colitis proper.



45. Girl 3 months old. Hereditary tuberculosis. Milk diet from the bottle. Had presented during tuberculous patient





15 days fetid diarrhea and broncho-pneumonia had declared itself. In the same house there was a
us bacilli in the sputa.

(3) The majority of cases belong to the second type in one or other of its numerous orms.

(4) The promoting causes of entero-colitis in Havana are due (*a*) to the deplorable ygienic condition of the city, deficiencies in the public administration, infection of ie soil, air, and water; (*b*) to the indiscriminate employment of cow's milk or of ther articles of food not suited to the child's age.

(5) Other causes, such as exposure to cold, summer heat, the use of the feeding ottle, the process of dentition, constitutional weakness, etc., render the infant's rganism more susceptible or promote the pathogenous action of the infectious gent.

(6) From an etiological point of view the cases may be classed in three principal roups: (*a*) Intoxications through the ptomaïnes contained in the milk or other food lministered to infants; (*b*) toxi-infections occasioned by saprophytes (intestinal pticæmia of Bouchard), such as Hayem's bacillus or the bacillus coli communis, hich are apt to become pathogenous under certain biological conditions; (*c*) Specific fections having a tendency to become primarily localized in the intestines, such result from malaria or from influenza.

(7) The pathological process consists in intestinal symptoms more or less marked, id of infectious origin, sometimes latent, and in secondary phenomena due to a eneral auto intoxication in which different organs may be involved in variable egrees, the kidneys being constantly affected.

(8) The extension and severity of the disorders are subordinate on the one hand to e nature, abundance, and virulence of the morbific agent, and on the other to the dividual conditions of the patient. Hence it may be readily conceived that an sensible gradation must exist, from the mildest cases of apyretic diarrhœa to the ost characteristic and most violent forms.

(9) The clinical phenomena presented by the patient do not always bear a conant relation to the nature of the infectious agent. In other words, the specific rm of the disease does not depend on the specific nature of the etiological or icrobic agent. Thus a given infectious agent, the bacillus coli communis, for stance, may occasion a simple diarrhœa, an enterocolitis of inflammatory type, the clinical phenomena of cholera infantum; and inversely, the chemical and ological alterations in milk, the saprophytic germs, the bacillus coli communis, ayem's microbe, or malaria are capable of producing local and general disorders milar in form, duration, and intensity to those of the morbid process under conleration.

(10) The clinical diagnosis, therefore, can only be said to correspond to a particur etiological origin after this has been proved through a series of minute and tensive inquiries, for which clinical sagacity, laboratory investigations, and pathogical anatomy must be called in aid before scientific accuracy can be attained, herwise the specific origin of the case must remain undetermined.

(11) In Havana a majority of the cases of enteritis proceed from infections occaoned by intestinal microbes. Next in frequency come the intoxications through omaïnes contained in milk or in other articles of food. Third in order are those casioned by malaria and influenza. Such is the upshot of our most careful quiries.

(12) The treatment must depend both on the nature of the cause and on the nical form of the morbid process. (*a*) First in rank stand purgative medicines, lomel in particular. Next intestinal antiseptics, water diet, and scrupulous alientary hygiene. (*b*) If malaria or influenza be suspected, quinine must be given. Attention to particular symptoms and their appropriate treatment must not be itted.

(13) The success of the treatment will often depend on a timely intervention on part of the physician, and also on such a selection of therapeutic agents as a ficient experience of infantile ailments is likely to suggest.

TYPES OF GASTRO-INTESTINAL DISEASE PREVALENT IN NEW YORK.

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No region or country is exempt from the gastro-intestinal diseases of young children. In rural districts, where breast feeding is the rule, or where artificial food is obtained fresh and pure, they are at a minimum. In the crowded centers of population, where the people are herded in most unhygienic surroundings; where weak and puny children are born by the thousand in homes of poverty and vice; where artificial feeding is common; where milk is contaminated and many hours old when first received, they reach their maximum. In New York over 30,000 young children have died of diarrhœal diseases during the last decade. From June to October the dispensaries are crowded with these little patients. The physician who practices among the well-to-do sees less of these disorders, for his families flee from the city and its dangers during the hot weather, but no general practitioner who remains in town escapes them entirely.

It is not my purpose to discuss the etiology of the gastro-intestinal diseases, but rather to study their prevailing types as they present themselves in New York. The character and type of diarrhœa is modified by three factors; climate or season, social conditions, and food. It is not now the common belief that heat, *per se*, causes diarrhœa. That it is a powerful factor indirectly is undoubted, for it lowers the vitality of the patient and favors fermentative changes in milk and the growth of pathogenic germs. Digestive disorders occur during every month of the year, but they do not become prevalent or very serious until June. There is occasionally considerable hot weather in May, but diarrhœa does not prevail to a serious degree. It frequently happens that no case appears in the large dispensaries before the 10th of June. The first case seen at the Polyclinic developed one season on June 10, the next season on June 7, while this year the first case did not appear until June 19. Serious development of the disease does not, as a rule, occur before June 20. It is most prevalent during the first ten days of July, the numbers being but slightly diminished during the second ten days. After July 20 the number of new cases decidedly diminishes. During the six weeks between July 20 and September 1 the development of new cases is remarkably uniform, being less than half that of early July, although the difference of the average temperature of these periods is but one or two degrees. During the first half of September the number of new cases is remarkably diminished, but during the latter half of the month there is a decided increase. The accompanying table shows the date of onset of diarrhœa from June to November.

It would be an error to conclude that these variations are due to heat alone. Observation has abundantly proved that when the mean temperature has reached a certain point (about 60° F.) an increase of temperature is not of necessity followed by an increase of the gastro-intestinal diseases. Numerous factors contribute to the results shown by the chart. One of the most important, it seems to me, is the fact that large numbers of feeble, marasmic babies are ready to succumb as soon as hot weather produces conditions favorable to the development of diarrhœa. It is simply the working of the law of natural selection. The unfit are the first to perish. It must not be supposed that the chart shows the actual number of patients under treatment at any time. Many children who sickened in July continued ill in August. The actual number of children under treatment in August is greater than would be indicated by the chart.

The chart is especially interesting in our present study, as it maps out very clearly marked changes in the type of the disease. During June and early July the prevailing types are those of acute dyspeptic diarrhœa. In grouping these cases I use Dr. Holt's classification in Keating's Cyclopædia. In recording the histories careful

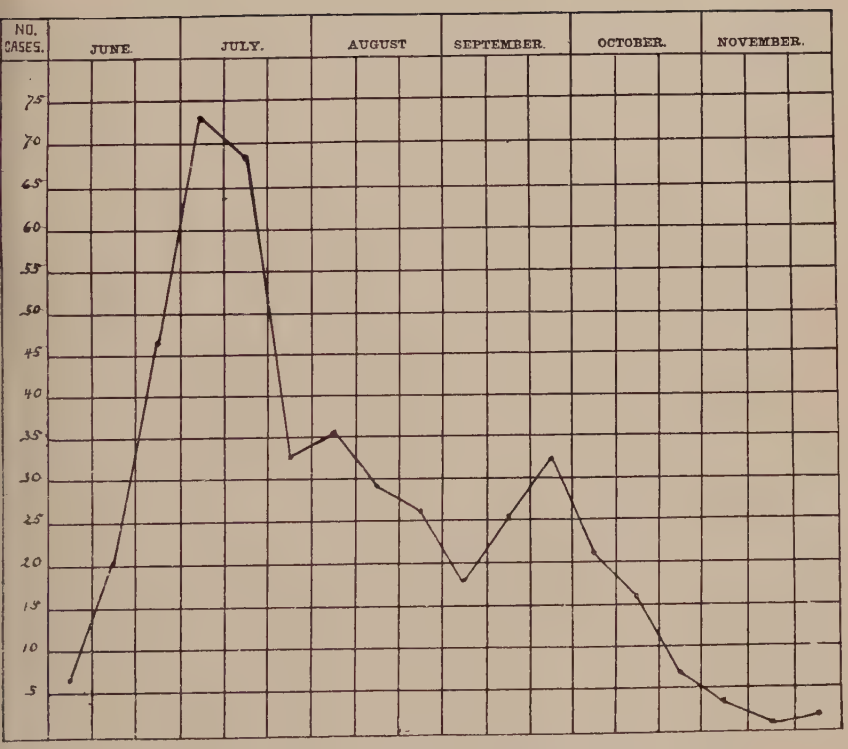

TABLE SHOWING THE DATE OF ONSET OF DIARRHEA DURING FOUR YEARS.

observations were made of the character of the stools and their exact number. Until July 20, twenty or even more stools in twenty-four hours are common. After that date it is rare to find that number. Serous diarrhœa, marked by numerous profuse, thin, watery passages, is common in June and July. In August the prevailing disease is marked by thicker grumous stools much less frequent in number. Acute dyspeptic diarrhœa prevails in July, entero-colitis in August, but in August even dyspeptic diarrhœa shows less tendency to assume a serous type than it does in July.

Early in September diarrhœa markedly decreases, but later in the month there is a decided increase. There is now a third and very radical change in type. The prevailing disease is so-called dysentery. I am well aware that the term dysentery is not, from a pathological standpoint, proper. The term dysenteric diarrhœa expresses, however, the type of the prevailing disease. The passages are very frequent and small. They consist chiefly of thick mucous and blood and are accompanied by true tenesmus, high fever being present as a rule. These cases are frequently found grouped in certain tenement houses, or in certain streets, and are apparently due to some contagious influence. A chart for 1889 would show the September rise far more marked than the one before you. Observation during the past four summers confirms the view which I expressed in a paper read in 1890 that there are three quite distinct periods. The first begins about the middle of June and terminates about the middle of July, in which diarrhœa is more prevalent than at any other time, the serous type being common. The second extends from the last of July to the middle of September, during which comparatively few cases develop. The number of cases under treatment, however, is large, for entero-colitis is common, dating back, in many instances, to a dyspeptic diarrhœa in July. The third period occurs during the latter part of September, in which the cases are largely of a dysenteric type.

I have been unable to demonstrate that age has any material effect upon the type of the disease. The statement that very young children are especially prone to serious diarrhœa has not been born out. Of patients suffering from dysenteric diarrhœa over 80 per cent were under 14 months. That form of the disease seems prevalent chiefly among infants and children of 10 or 12 years. As an etiological factor, age is very important. I showed in the paper referred to that in 3,000 cases occurring in New York 84.1 per cent of the patients were under 2 years of age, and 53.2 per cent were between 6 months and 18 months.

The following observations were made upon 541 patients during the four years beginning with 1889. A history of disordered digestion preceding the diarrhœa, as slight diarrhœa, constipation, or indigestion, was obtained with certainty in 41 per cent of the dyspeptic cases. In a very large number of cases previous condition could not be obtained with certainty. Entero-colitis was almost invariably preceded by diarrhœa more or less continuous for a period ranging from a few days to several weeks. Well-defined entero-colitis develops with extreme rarity in perfectly healthy children. The onset was sudden in 72 per cent in the dyspeptic cases. It was frequently so definite that the mother could state the day and hour at which the first symptoms appeared. In the remaining cases the onset was gradual or uncertain. In entero-colitis the exact date of onset or transition from dyspeptic diarrhœa could be determined in but 20 per cent of the cases. The onset of well-marked dysenteric diarrhœa was sudden and definite in over 90 per cent of the cases. A curious fact was developed in this connection in studying the cases of two years. The interval between the onset of the diarrhœa and the first visit to the physician was found to be in June 1.3 days, in July 3.8 days, and in August 2.9 days. Hence, in August the child was brought for treatment almost one and one-half days earlier than in June. This is perhaps explained upon the ground that mothers did not appreciate the dangers of diarrhœa in June. In August, warned by personal experience or that of their friends, they sought medical aid earlier.

The number of passages per day was noted in 438 cases. In dyspeptic diarrhœa

they varied from 2 or 3 per day to 20, 30, or more, the common range being from 6 to 15. In entero-colitis the extremes were about the same, but the usual number was more constant, ranging from 8 to 12. In dysenteric diarrhœa the extremes were 8 to 40, the average number being large; 12 to 20. Within certain limits the number of passages is not a criterion of the seriousness of the disease. Some of the most serious and fatal cases which confront us are those in which the passages are large but not watery, of excessively offensive odor, and occur only at intervals of several hours. There may be but 2 or 3 in a day. They show a tendency to group themselves. An interval of five or six hours, or even longer, will pass with no passage. Then 3 or 4 will occur in quick succession, to be followed by another long interval without passages. The temperature in these cases ranges high and the constitutional disturbance is profound. The natural tendency is to terminate in death by toxæmia. This type is not uncommon in New York. It illustrates very forcibly the fact that diarrhœa is, strictly speaking, a symptom, not a disease. Here we have excessive decomposition of the intestinal contents with grave constitutional disturbance, with very slight diarrhœa. The physician whose sole object in the treatment of these disorders is to check diarrhœa would lose cases of this character. The diarrhœa is a conservative process and is to be encouraged.

Allied to these cases are those in which the symptom of diarrhœa appears late. The child is fretful, restless, and apparently ill, with more or less fever. This condition will continue for several hours—sometimes twelve hours or more—the bowels being constipated. When at last they do act, either naturally or as the result of a cathartic, the physician suddenly finds that he has a fully developed dyspeptic diarrhœa to deal with. The temperature is sometimes very high, and the diagnosis is uncertain until large grumous, foul-smelling passages indicate the nature of the disorder. The temperature usually falls when the bowels act, but as a rule, unless active measures are taken, recovery does not occur.

Diarrhœa of the serous type is common early in the season, as we have already seen. It is not, however, true cholera infantum. It seems to me unwise to apply that term to ordinary summer diarrhœa. Cholera is a disease characterized by certain peculiar symptoms, and the term cholera infantum should be restricted to a well-marked but rather rare type of disease simulating cholera. I have seen in New York but five or six well-marked and typical cases of this class. In the western part of the State of New York it is somewhat more common than in the city. I would restrict the term to a disease which appears suddenly and is marked by frequent and profuse watery passages, which quickly drain the fluid from the body and reduce a strong child in a few hours to a state of extreme danger. The temperature ranges high. Constitutional disturbance is profound. Prostration is alarming. The whole aspect of these cases, as I have seen them, is entirely different from that of ordinary dyspeptic diarrhœa, even when the stools are large and serous in character.

The color of the passages varied from the clear, watery, colorless stools of cholera infantum and yellowish, watery, serous passages to yellow, green, brown, and black. Green more or less decided, appeared at some period in 71 per cent of all the cases. Blood was present in the passages at some time in 29 per cent of the inflammatory cases, not including the dysenteric, but was rarely profuse. It appeared in at least 13 per cent of 274 dyspeptic cases, usually at the outset, and was several times profuse. The idea that blood is a symptom of inflammation or of lesions has no foundation in fact. In several instances the blood appeared in the first passage, but soon ceased, and the patient recovered without any symptoms of inflammation. Vomiting was present in 63 per cent of the dyspeptic cases. It usually occurred early and frequently ceased after the first day or two, but was often persistent. It was more common in cases marked by watery passages and not infrequently preceded the diarrhœa. Vomiting occurred in 43 per cent of the inflammatory cases. It was not often persistent or continuous, nor as troublesome as in the preceding type.

Pain is a somewhat uncertain symptom in young children. In dyspeptic diarrhœa it was sometimes abdominal and griping, but more commonly seemed to be of a bearing-down or straining character. There was frequently abdominal tenderness, but this was by no means a constant symptom. Pain was evidently present to a greater or less degree in most of the inflammatory cases. It was commonly of a bearing-down nature, and was sometimes a true tenesmus, accompanied not infrequently by a partial or complete prolapse of the rectum. Abdominal tenderness was, as a rule, present, usually in the umbilical or right iliac region, but distension or tension of the abdomen was not constant.

Temperature records in dispensary patients are necessarily imperfect. Seventy-two per cent of the dyspeptic cases questioned gave a history of fever or feverishness, usually at the outset. Only 21 per cent of the whole number, however, showed a temperature of more than 100° at their first visit. It was frequently normal. In the septic type already described, marked by infrequent, offensive passages, the temperature ranged high throughout, occasionally reaching 105° or 106° in fatal cases. Inflammatory diarrhœa, was almost invariably marked by some elevation of temperature, ranging usually from 995° to 103°. Except in cases of a dysenteric type, it was rarely very high. A slight, somewhat intermitting, but persistent, temperature was the rule in entero-colitis.

From these studies we are able to present the following general description of the gastro-intestinal diseases common to young children in New York: The dyspeptic form is commonly preceded by a disordered state of digestion. The onset may be gradual, but is usually definite and often sudden. Fever is generally present in the early stages, but thereafter is not constant. Two general forms are common, but are not sufficiently distinct to be classed as different varieties. One is characterized by watery, brownish, greenish, or light-colored passages, occurring from 10 to 20 or more times a day, accompanied frequently by vomiting, which is sometimes persistent. This is the so-called serous or choleraic diarrhœa. Classical cholera infantum is a rare disease. The other class, much more common, is characterized by semi-solid passages, composed of fæcal matter, white curdy masses, or undigested food, mingled with serum, mucus, or blood, and of a variable color, but more often green. Fever, pain, and vomiting are frequent. The first form is rarely well defined, but usually originates from the second or merges into it, the same patient presenting at different times symptoms referable to each.

Entero-colitis, as a rule, develops gradually from a dyspeptic diarrhœa. The passages are usually green, and frequently contain blood, mucus, and pus. Pain and abdominal tenderness are commonly present, and not infrequently true tenesmus. Vomiting is common, but not persistent. Fever to a slight degree is invariably present, but, being in some instances intermittent, single thermometric observations may fail to detect it. The course of the disease is extremely variable.

SUR LES DYSPEPSIES DES JEUNES ENFANTS A RIO DE JANEIRO.

Par le Dr. MONCORVO,

Membre correspondant de l'Académie de Médecine de Paris.

Les troubles dyspeptiques se présentent avec une fréquence exagérée chez les enfants au Brésil. Il y a lieu d'admettre deux groupes distincts de gastropathies dans l'enfance: un premier groupe qui comprend celles provenant exclusivement des écarts de régime alimentaire (allaitement naturel vicieux, allaitement artificiel, sevrage prématuré, alimentation grossière ou mal distribuée, etc.), et un autre où les troubles dyspeptiques sont engendrés primitivement par l'affaiblissement général de l'organisme ou par un état encore presque physiologique comme il arrive par l'anémie tropicale et l'impaludisme latent. Dans des cas pareils les enfants peuvent

devenir dyspeptiques, encore même qu'ils soient maintenus à un régime alimentaire bien dirigé.

Il est inutile d'ajouter que, dans les cas de ce genre, les maladies dystrophiques héritées ou aqueuses jouent le rôle assez important de cause prédisposante.

Enfin, on pourrait ajouter aux précédents un troisième groupe des troubles gastro-intestinaux d'ordre secondaire, presque inséparable à la plupart des maladies aiguës de l'enfance, et d'un grand nombre d'affections chroniques propres à cette période de la vie.

Les désordres du premier groupe sont chez les nouveau-nés annoncés tout d'abord par les caractères des garde-robes, ensuite par l'intolérance gastrique; ce sont des selles plus ou moins fluides, granuleuses, verdâtres, renfermant une assez forte proportion de mucus, des granulations graisseuses et des caillots de caséine non digérée. Elles sont très fétides dans la majorité des cas; c'est l'odeur acide qui attire tout de suite l'attention de ce côté. Enfin le papier de tournesol décèle l'acidité de ces matières. Lorsque le régime vicieux agit d'une façon constante, les désordres s'aggravent de plus en plus, et bref, on a sous les yeux le tableau saisissant de l'athrepsie de Parrot. Il convient d'observer que celle-ci est bien loin d'avoir ici la fréquence signalée ailleurs, et cela semble tenir en quelque sorte à ce qu'au Brésil il n'est point fort commun de voir l'allaitement artificiel adopté exclusivement pendant les deux ou trois premiers mois de la vie. Le lait de la mère ou de la nourrice atténue presque toujours les inconvénients des écarts du régime.

Le sevrage prématuré, l'administration d'aliments lourds et grossiers, donnent ordinairement lieu aux troubles dyspeptiques retrouvés aux autres périodes de l'enfance. C'est alors qu'il est très fréquent de voir ces accidents digestifs coïncider avec la dilatation du ventricule. La gastro-ectasie que j'ai décrite le premier, en 1882, chez les jeunes sujets, est ici d'une fréquence bien supérieure à celle constatée, après mes travaux, à l'étranger, notamment en France et en Allemagne.

Chez les tout jeunes sujets dyspeptiques, les troubles digestifs se dénoncent d'abord par la longueur de la digestion gastrique; l'estomac qui, dans les conditions physiologiques se vide parfois avant une heure après chaque tètée, renferme encore du lait coagulé une heure et demie à deux heures même après. Cette digestion languissante va se compléter ensuite dans le duodenum, mais dans un assez grand nombre de cas la peptonisation y est encore imparfaite, ce qui explique la présence dans les garde-robes d'une certaine quantité de caséine (lientérie). Cette stagnation du lait dans le ventricule entraîne naturellement à la longue la dilatation de cet organe, notamment lorsque les désordres chimiques se produisent chez un enfant distrophique ou affaibli par quelque maladie intercurrente. Dans ce cas, la gastroectasie obéit à des causes complexes dépendant tant de la réplétion ventriculaire que de l'atonie de la couche musculaire, dont l'excitabilité s'épuise si promptement à l'âge dont je m'occupe.

Jusqu'à ce jour le meilleur réactif pour bien juger des fonctions digestives des nourrissons était l'aspect et la composition des selles. À vrai dire, l'examen des garde-robes rend assez de services au diagnostic des troubles gastro-intestinaux, mais les progrès de la chimie biologique vinrent jeter assez de lumière à l'étude du liquide gastrique au cours de la digestion. Je fus donc tenté d'explorer le suc gastrique chez les jeunes sujets en utilisant pour cela des réactifs colorants, tels que la tropæoline (oranger-poirier No. 4), indiquée par Van der Velden, le violet de méthyle par Laborde, le vert brillant employé par Jachs et Lepine, et surtout le phloroglucine-vaniline conseillée par Güntzbourg de Frankfort et par G. Sée. Enfin, j'ai eu également recours au réactif de Boas, c'est-à-dire une solution alcoolique à 5 pour cent de résorcine additionnée de 3 pour cent de sucre de canne. Tous ces réactifs furent employés à la recherche du suc gastrique. J'ai adopté le réactif d'Uffelmann pour celle de l'acide lactique.

La recherche de l'acide chlorhydrique libre doit être pratiquée vers la fin de la période ordinaire de la digestion, car avant cela la réaction alcaline du lait s'y

oppose, ainsi qu'il est facile de constater au laboratoire. L'acidité du liquide gastrique peut être due avant cela à la présence de l'acide lactique; on en doit tenir compte pour se soustraire à des erreurs.

Dans mes recherches, je rangeai dans un premier groupe des petits sujets n'ayant pas dépassé la première année; dans un second je rassemblai ceux de la deuxième année; enfin un troisième groupe comprit les enfants de deux à sept ans.

Ces sujets étaient presque tous hérédo-syphilitiques, paludiques, vivaient dans des mauvaises conditions hygiéniques et présentaient tous des désordres gastro-intestinaux. D'après mes examens répétés chez eux par rapport à la composition de leur suc gastrique, j'arrivai à cette conclusion que le déficit de l'acide chlorhydrique y constitue la règle. L'extrême efficacité de la chlorhydrothérapie dans les cas de ce genre ne fait que confirmer les résultats des recherches chimiques. C'est donc l'hypochlorhydrie ou l'anachlorhydrie qui explique l'imperfection gastrique chez les jeunes enfants.

Un fait semble résulter aussi de cette expérimentation clinique: c'est le rôle important que joue le ventricule dans la digestion des nouveau-nés; au contraire de ce qu'ont prétendu affirmer certains pédiatres. Au fait, dans les cas où les troubles digestifs deviennent assez accusés, il est très commun de retrouver dans le ventricule du lait coagulé, deux heures et plus après son ingestion; ce qui démontre l'imperfection de la digestion gastrique. Enfin, la disparition de la lientérie, à la suite de la chlorhydrothérapie, semble bien le confirmer.

Les cas d'hyperchlorhydrie ne sont, à cet âge là, que des faits exceptionnels, du moins d'après mon observation personnelle. Il faut, en tous ces cas, établir une distinction entre l'anachlorhydrie ou l'hypochlorhydrie passagères, dues à des causes accidentelles et transitoires dans le cours même d'une santé florissante, et le déficit chlorhydrique permanent qui constitue une affection bien établie et d'une durée qui est presque toujours loin d'être courte. C'est dans les cas de cette nature que se présente cette lientérie presque constante qui tend parfois à s'éterniser. La lientérie est donc un facteur fort digne de remarque dans la séméiologie des troubles dyspeptiques à cette époque de la vie. Ce fait a été déjà signalé par moi, en 1877, dans un mémoire concernant la lientérie dans l'enfance. J'y ai mis alors en relief l'influence probable de la chaleur sur le déficit chlorhydrique, tout en comparant la situation de mes petits sujets à celle étudiée par Gallard en France chez les individus obligés par leur profession à vivre dans un milieu trop chaud.

Chez les enfants du deuxième groupe, la lientérie est également un phénomène fréquent et coïncide presque toujours avec la dilatation gastrique. Cela se voit plus souvent chez les sujets dystrophiques et porteurs de troubles digestifs de date ancienne.

APPENDICITIS IN CHILDREN.

By JOHN B. DEAVER, M. D.,

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I have selected the subject of appendicitis in children as my contribution before this section for the following reasons: First, because the disease is one which occurs frequently in early life, and, from some similarity of symptoms, is likely to be confused with and mistaken for some one of the various intestinal disturbances peculiar to children; second, because the gravity of the disease is such that upon its early recognition depend in a great degree the chances of recovery; third, because I desire to advocate the removal of the appendix in the acute primary attacks as soon as the disease is recognized, where there has been no decided response to judicious medical treatment, and between attacks in all recurrent cases.

In a paper read before the last meeting of the American Surgical Association I maintained that all inflammations located in the right iliac fossa have their origin in the appendix, such a conclusion being the inevitable result of observations at both the operating and post-mortem tables. I also proposed that the terms typhlitis, perityphlitis, and paratyphlitis should be expunged from the medical vocabulary as being misleading in their character and as presenting a classification which is anatomically unfounded, and which clinically is incapable of demonstration. I would therefore group under the terms appendicitis all inflammatory conditions of the right iliac fossa, believing that in so doing a clearer conception will be formed of the true pathological conditions present, and that a common treatment, that of early operative interference, will be adopted universally.

All cases of appendicitis may be classified under the following heads: Catarrhal; ulcerative, which may be the result of a circumscribed catarrhal inflammation or of an obstruction due to the presence of a foreign body, as a fæcal concretion, an enterolith, a stricture, etc.; perforative, an advanced stage of the ulcerative type; tubercular; and relapsing or recurrent.

Pathological changes.—The pathological changes occurring in cases of appendicitis vary according to the exciting cause, but are usually those common to inflammations of the intestinal tract, and may present any of the conditions from a simple lymph exudate to a pus formation.

Ætiology.—Inflammation of the appendix may be the result of either predisposing or exciting causes. Among the predisposing causes age is an important factor, 15 per cent of all cases occuring under 15 years. The youngest case I have met with was in a child 2 years old. Males are more prone to the disease than are females. A tubercular diathesis is not uncommonly the remote cause of a suppurative appendicitis. Chronic constipation is a further predisposing cause, which may induce either a catarrhal or an ulcerative type. Among the exciting causes may be mentioned the presence of seeds, enteroliths, fæcal concretion, inspissated mucus, particles of undigested food, traumatism, and exposure to cold or dampness, but the most frequent exciting cause is the result of a previous attack.

History and symptoms.—The onset is usually sudden, constipation the rule rather than the exception. We may be able to elicit a history of one or more previous attacks or of the rapid ingestion of some indigestible substance or overloading of the stomach. The symptoms of appendicitis in its incipiency are not by any means definite in all cases. The prominent and constant symptoms are pain, vomiting, and tenderness. The pain which is at first paroxysmal, in this respect resembling colic, is referred to the umbilical and epigastric regions, and in 72 per cent of all cases appears within twenty-four hours. Later it becomes continuous, and is localized in the right iliac fossa in 54 per cent of all cases. Vomiting is present from the first, becoming uncontrollable if the case does not yield to treatment. The vomited matter consists first of the contents of the stomach, later of bile, and finally, if a plastic peritonitis supervenes by which the coils of intestines are immobilized from the resultant deposit of lymph, of stercoraceous matter in those cases in which the intestinal tract has not been emptied. Ordinarily the vomiting of stercoraceous matter is indicative of acute intestinal obstruction, yet we see stercoraceous vomiting in advanced and hopeless cases of appendicitis. The tongue is furred, and later in the disease becomes dry, with the deposit of sordes upon the teeth. There is extreme thirst, with a temperature varying from 102° to 104° F., and a high pulse rate. The bowels are usually confined; it is, however, not uncommon to have the disease ushered in with diarrhœa. The presence of sick stomach, diarrhœa, and pain coming on suddenly are suggestive of enteritis, the affection with which acute appendicitis in its incipiency is most likely to be confounded. As the affection advances, the child frequently favors the affected side and lies with the thigh of the corresponding side flexed upon the abdomen. Frequency of urination is often a prominent symptom, being due evidently to the involvement of the sympathetic nerves.

Examination by palpation reveals general tenderness over the affected area, while the point of greatest intensity usually corresponds to the so-called McBurney point, providing the appendix occupies its most common position, arising from the postero-internal aspect of the base of the cæcum. I recall one case in particular where the greatest point of tenderness was immediately above the middle of Poupart's ligament. This, as demonstrated at the operation, corresponded to the angle of curve in the appendix which arose from the postero-external aspect of the base of the cæcum and descended in front of it as far as its apex, when it turned abruptly upward. When general peritonitis is present early, as in the perforative variety of the disease, notwithstanding that there is a very general abdominal tenderness, yet upon deep pressure a point in the right iliac fossa corresponding to the appendix can be made out which is much more painful than any other point in the abdomen. Palpation also detects very decided resistance offered by the abdominal muscles of the affected side. In many cases an indurated mass is to be felt, which is circumscribed or diffused, particularly in the direction of the linea alba and of the pelvis. Superficial percussion in the early part of the disease yields negative information, while deep percussion, if the case steadily advances, will reveal dullness and later flatness. Deep rectal as well as vaginal examination I do not think of much diagnostic value, early in the disease at least. In those cases where the appendix projects into the pelvis it may be of some assistance. If a mass can be felt through the rectum or the vagina, palpation of the abdominal walls at the same time may elicit fluctuation. Suppuration is not always readily detected, as fluctuation is difficult to elicit on account of the unyielding abdominal wall. Yet I have seen it well pronounced many times. Edema of the overlying abdominal walls is of great diagnostic value as indicating the presence of deep suppuration. If, associated with the presence of a mass in the right iliac fossa, there are decided chills, or even chilly sensations with sweating, it is quite evident that pus is present.

Diagnosis.—The establishment of a diagnosis depends on the character of the symptoms, the clearness of the history, the duration of the disease, and the previous treatment, as the administration of opiates to relieve distressing pain may mask many symptoms which would otherwise be prominent. The affections with which appendicitis is most likely to be confounded in children are enteritis, involving all the coats of the intestine (enteroperitonitis); acute mechanical intestinal obstruction; perinephritic abscess; abscess of the kidney, and especially so if the kidney be a floating one, as I have once observed; psoas abscess; iliac abscess; abscess of the abdominal parietes; hip disease, hepatic and renal colic. In enteritis, involving all the coats of the intestine, the disease is ushered in by a diarrhœa of a more or less severe type, in which the stools are watery and mucoid in character. This is accompanied by pain of a colicky nature referred to that portion of the abdomen corresponding to the situation of the affected coils of intestine; also by the absence of abdominal distention. Later, however, when the muscular and serous coats are invaded by the inflammatory process as a consequence of the infiltration and the involvement of the sympathetic nerve filaments supplying the coats of the bowel, paralysis of the bowel occurs which results in distention. Diarrhœa is now no longer present, but on the contrary, absolute constipation with inability to pass flatus. Vomiting occurs, which if the disease is not relieved become stercoraceous. Ordinarily there would be but little trouble in differentiating between this form of enteritis or entero-peritonitis and appendicitis if the symptomatology of the latter affection is borne in mind, in addition to what has been said about the physical signs elicited by careful abdominal palpation in cases of appendicitis.

In acute mechanical intestinal obstruction the two most common forms met with in children are invagination and strangulation by bands; the onset of the symptoms is much more abrupt and severe than they are in appendicitis. In invagination, as in strangulation by bands, the pain, which is most intense and at first occurs in exacerbations, is referred to the seat of the obstruction, or more commonly to the umbilicus, and not concentrated in the right iliac fossa, as is the case in appendicitis

when the disease is well established. There is absolute constipation with inability to pass flatus. Vomiting is an early symptom in both forms of obstruction, which, if not relieved, becomes stercoraceous. When peritonitis supervenes there is very little effort attending the vomiting. Properly speaking, the patient at this stage of the disease regurgitates fæcal matter, caused by the reversed peristalsis. There is absence of fever in strangulation by bands and in invagination unless the child survives until the invaginated portion of the bowel commences to undergo inflammation, which causes ulceration and affords nature a means of disposing of the intussusceptum, and thus establishing a spontaneous cure. In invagination the presence of a movable tumor, the most common site of which is to the left of the middle line, but not always to be made out on account of the distension, while in appendicitis a tumor, if present, is fixed and always occupies the right iliac fossa, are important differential points. In invagination a discharge of blood and mucus from the rectum, and in many instances the presence of a tumor, may be detected upon making a digital examination of the rectum. With the development of peritonitis in acute intestinal obstruction there is marked distension of the abdomen. Collapse is an early symptom in acute intestinal obstruction, while not so in appendicitis unless it be of the perforative or fulminative variety; but even then it is a later manifestation than in obstruction. In perinephritic abscess the location of the swelling, the presence of edema in the loin, and the absence of bowel symptoms are important differential factors. In many cases of perinephritic abscess the trouble is preceded or accompanied by the presence of pus as well as other abnormities in the urine. This is not, however, true in those cases which have their origin independent of the kidney, as when due to constipation, traumatism, etc. In perinephritic abscess, as in some cases of appendicitis, owing to the relation between the perinephritic tissue, the appendix, and the psoas magnus muscle, flexion of the thigh upon the abdomen is a symptom common in both affections. If a doubtful case should arise where it would seem to be impossible to differentiate, better than introducing an exploring needle or an aspirating needle, either of which procedures under these circumstances I regard as most unsurgical and attended by no little danger, I would advise an exploratory incision in the loin before cutting through the abdominal wall anteriorly. This could not possibly result in any harm, even if the perinephritic space be found intact; nor would it interfere in the least with immediately cutting down upon the appendix. In abscess of the kidney the same train of symptoms is largely present as in perinephritic abscess, namely, a mass in the loin corresponding to the position of the kidney, pus in the urine, history of renal colic, with perhaps the passage of small crystals of uric acid; yet, to have renal colic it is not necessary that a stone or a fragment thereof should pass through the ureter, but simply a plug of fibrin or inspissated mucous, as I have seen upon several occasions in cases of pyelitis. In kidney abscess, nausea, with sometimes vomiting, is a not inconstant symptom. In the absence of urinary symptoms, abscess of the kidney, and particularly if it be one of a floating kidney, the differential diagnosis is necessarily more difficult. In the latter instance, however, the tumor will be movable; a point to be borne in mind. I have recently operated in the case of an acute suppuration of the kidney where the urine was normal and where the diagnosis was made purely upon the anatomical situation of the swelling. In psoas abscess the onset is slow, with little or no fever, usually, though not always, accompanied by evidence of disease of the vertebræ, absence of pain, tenderness, and bowel symptoms. There may be flexion of the thigh of the corresponding side due to the muscular irritation. What has been said of psoas is equally true of iliac abscess, if dependent upon bone disease. Should a collection of pus in the iliac fossa be dependent upon disease of the uterine appendages, a vaginal examination would reveal the cause. In the latter variety of abscess, however, the swelling usually holds a lower position than abscess, the result of disease of the appendix, it being near Poupart's ligament, in fact, immediately above it.

Abscess of the abdominal wall.—Between abscess of the abdominal wall and that caused by appendicitis there should be but little difficulty in arriving at a correct conclusion. If the collection is in the superficial fascia it will be circumscribed, while if between the abdominal muscles it is likely to be diffused. The purely local character of the abdominal abscess, the swelling moving with the abdominal walls, the absence of intestinal symptoms, the presence of local and constitutional evidence of pus, coupled with the history of the case, should be enough to render a differential diagnosis possible.

Hip-joint disease.—The presence of the characteristic deformity, inability to execute the normal movements of the joint, pain referred to the knee, arching of the lumbar spine when the limb is brought into the fully extended position, absence of intestinal symptoms. If there is still doubt, the administration of an anæsthetic will suffice to dispel it.

Hepatic colic.—In hepatic colic the painful area is usually higher in the abdomen, radiating toward the shoulder, most severe over the region of the gall bladder, and usually followed by jaundice.

Nephritic colic.—In nephritic colic a history of previous attacks may often be obtained. The origin of the pain is deep in the upper loin, radiating in the line of the ureter, with retraction of the testicle, diminished urinary flow, with blood or pus, and a sudden termination of the attack. Retraction of the testicle may occur in appendicitis, due to irritation of the genito-crural nerve. I recall a case of a physician in which the diagnosis of renal colic had been made, and in which the ureter was supposed to have been ruptured by the passage of a calculus. The autopsy revealed a gangrenous and perforated appendix, with diffuse suppurative peritonitis.

Prognosis.—The age of the patient has a material effect upon the prognosis. The earlier in life it occurs the less resisting power is exhibited by the patient. Sex does not seem to be a factor. Where an abscess forms and ruptures or perforation takes place, and the contents of the bowel escape unconfined by a wall of lymph, general peritonitis is rapidly established, terminating these cases with a fatal uniformity. The most favorable point for spontaneous evacuation of the contents of an appendicular abscess is into the cæcum. Rupture into the rectum is also followed by recovery in the majority of cases. Rupture into the bladder is fatal in about 50 per cent of the cases. The most favorable results have been recorded where early operative interference was instituted, the mortality under this plan of treatment being but 6 per cent.

Treatment.—The first indication to be fulfilled in a case of appendicitis, or even of a supposed case, is to obtain a free action of the bowels. This is best accomplished by the administration of small and repeated doses of salines, preferably Rochelle salts, or, if the stomach is not tolerant of salines, small doses of calomel. The free evacuation of the bowels, not drastic purgation, serves the purpose of clearing the alimentary canal of all foreign and irritable substances, as particles of undigested food, etc.; relieves the congested blood vessels, thus modifying the degree of the subsequent inflammation, and again fulfills a most important indication in having the bowels in the most favorable condition for operation in the event of its necessity. I can not emphasize this important part of the treatment too strongly, as upon it, I believe, largely depends the chances of the patient's recovery. Certainly, in my experience, the bulk of the cases I have seen recover without operation have been those where it was most thoroughly carried out, and in the cases operated upon the largest percentage of recoveries have been in those where the bowels were not allowed to be confined. Where there is great pain, as we frequently see, in addition to the administration of salines or calomel, as the case may be, we may be forced to used anodyne, and, if so, it should be given in the smallest possible dose.

The pain in appendicitis, which is colicky in nature, is due first to the muscular contraction of the appendix and the bowels, and in the majority of instances is pro-

voked by irritation within both. Therefore, is not the evacuation of the intestines of their irritating contents urgently called for? Are they not, in other words, asking to be relieved? This being so, will not purgation take the place of an anodyne, as a hypodermic of morphine, which is so often and indiscreetly given? In other words, the best anodyne is the repeated dose of salts or calomel, which does more than any preparation of opium can do, both relieving and removing the cause of the pain. Recognizing the character of the pain, is it not possible to afford relief by hot applications to the abdomen in the shape of the hot-water bag, hot cloths, hot turpentine stupes, etc.? Internally, before giving opium, I prefer to use spirits of chloroform, carminatives, or extract of belladonna. If now relief is not obtained, then I administer a small dose of opium, and preferably by suppository, as I think we all agree that opium given in this form is less liable to cause sick stomach. Sick stomach is so frequently provoked by morphine given hypodermically that it is often difficult to say whether the nausea or vomiting is due to the morphine or to the disease. Further, there is no disputing the fact that opium, or any of its preparations, brings about a paretic condition of the bowel, and thus favors distention, an obstacle difficult to contend with when endeavoring to elicit a mass.

If the case be catarrhal, the presence of congestion of the mucous lining of the appendix is the exciting factor in occasioning contraction of the muscular coat, which is the direct cause of the initiatory pain. Again, as has already been noted, emptying the bowels freely both removes an additional factor in exciting contraction of the muscular coat of the appendix as well as depletes the circulation and renders the canal more patulous and better able to free itself of mucus, which, if retained, becomes inspissated. The presence of inspissated mucus in catarrhal appendicitis is liable to lead to an ulcerative type of the disease. While I do not believe the good derived from purgation in the obstructive form of appendicitis is equal to that in the catarrhal type, yet I do not know of any other form of medication capable of accomplishing the same amount of good. There is some hope, too, in emptying the cæcum that the orifice of the appendix may be rendered patulous and the expulsion of the foreign body facilitated. In the perforative and explosive or fulminative varieties of the disease, the latter being only a difference in degree of the former, active purgation would be ill-advised on account of the fear of hastening and making greater the extravasation of fecal matter. The treatment by free evacuation of the bowels may be thought to be erroneous on account of the increased peristalsis resulting therefrom, aggravating the already existing inflammation. The use of leeches and blisters is advocated by many in preference to purgation to accomplish depletion of the circulation. I must confess this is not in accord with my experience. Blisters, I think, are particularly objectionable on account of the infiltration of the skin they occasion, which both interferes with palpation and the recognition of pus by the edema of the abdominal walls.

The question of diet throughout the disease is important, and it should consist—until the patient is convalescing, at least—of peptonized milk, koumyss, milk, and apollinaris or carbonated lithia water, liquid beef peptonoids, and concentrated beef tea, the latter being all the more indicated on account of its laxative effect. Buttermilk I find very grateful to many patients. As to the propriety of the removal of the appendix in cases of recurrent appendicitis, there is, in my mind, no doubt. While I am willing to admit that my experience has taught me that acute attacks of recurrent appendicitis are less fatal than primary appendicitis, yet I can not see how this argues against removal of the appendix between attacks, the period for elective operation. I am unable to understand the philosophy of the argument that because a patient has survived a number of attacks of recurrent appendicitis the appendix should not be taken out, since each recurring attack may possess elements of danger unknown to us which may deprive our patient of his life. Those of us who have observed these cases carefully know that many are the subjects of chronic invalidism. The percentage of mortality in operations for recurrent appendicitis in

skilled hands is less than 1 per cent. The absence of inflammatory conditions so simplifies the operation that its after conduct entitles it to be classed as a simple wound. This same absence of acute inflammatory condition which relieves the necessity for drainage and the consequent impairment of the integrity of the abdominal walls lessens in a great degree the liability to ventral hernia.

The after treatment of these cases is so simple that it deserves special mention. It consists during the first three days of alimentation alone, absolutely no opiate, and at the expiration of this time, if the bowels have not moved voluntarily, of the administration of one-tenth grain doses of calomel every hour or two until a desire to defecate is produced, when an enema is given.

Before discussing the operative treatment of this disease, and while advocating the most radical methods, I desire to disclaim any intention of declaring that all cases where the ordinary medical treatment of the general practitioner has failed to afford relief are cases for immediate operation, as I believe that such a decision should rest only with an experienced surgeon, who may have carefully observed the progress of the case. Further, that the operation should be done by one who is thoroughly prepared to dispose of any of the unlooked-for conditions which are likely to be met with in any case. The skill required for the rapid and thorough performance of appendicial operations must be of the highest order, as time lost and prolonged etherization (by which the patient becomes, as it were, water-logged) during an operation may be just sufficient to turn to a fatal termination what would otherwise have been a successful result. This is of special importance when operating upon children, as we well know they do not bear prolonged etherization or operation. In the gravest types of the disease, when there is a sudden abatement of the symptoms, the attending medical man or surgeon, as may be, must not congratulate himself upon the rapid recovery of his patient and overlook the fact that this is a forerunner of perforation. On the contrary, if operation has not already been entertained, the strongest indication for its immediate performance now presents itself. Following this period (which is practically one of shock) in the course of a few hours, usually 24, a general peritonitis has developed and the golden opportunity for offering the patient his only chance for relief is a thing of the past.

The technique of the operation for appendicitis where abscess exists varies by reason of the different local conditions found. When the abscess is circumscribed and shut off, after the pus has been evacuated and the cavity irrigated, if the appendix can not readily be found it is not judicious to make a prolonged search for it, by which the limiting wall may be broken through and a communication with the general peritoneum established. In this class of cases, however, I have been fortunate enough in most cases to find the appendix and remove it without breaking through the abscess wall. This is always more satisfactory to the surgeon than to complete the operation by simply draining or packing the abscess cavity, and it removes what may be the cause of one or more attacks of the relapsing variety of the disease. When the abscess is in communication with the general peritoneal cavity a more prolonged search for the appendix may be made with less risk than in the preceding state, but the patient's general condition is usually so bad under these circumstances as to make it unwise to keep him under the effect of the anæsthetic any longer than is absolutely necessary.

The points I observe in making the incision for the removal of the appendix in acute cases where there is present a mass, be it pus or exudate, are the following: When the loin is rendered prominent by the mass or is the seat of edema, I take it as an indication that the appendix holds a post-cæcal or an external antero-lateral position, or that it comes off from the apex of the cæcum, and I carry the incision parallel with and a short distance above the outer third of Poupart's ligament, prolonging it outward if necessary. When the mass presents itself well to the inner side of the anterior superior spine of the ilium I carry the incision through the semilunar line, rather, through the rectus muscle immediately to the inner side of

the semilunar line. The wound when carried through the muscle heals more solidly, and therefore there is less likelihood of the development of a ventral hernia than when made through the semilunar line.

In acute cases the treatment of the stump of the appendix will depend on its situation and the mobility of the cæcum; if the latter has become fixed through plastic adhesions, and it is not deemed advisable to make the manipulation necessary to bring it well up into the wound, the appendix is tied off *in situ*. If, however, it is possible to present the appendix in a favorable situation, a circular incision is made through the serous coat half an inch from the cæcum and the serous coat then stripped for the space of a quarter of an inch. The appendix is then tied with fine silk, the serous covering replaced with edges inverted and brought together with a Lembert suture. The latter disposition of the appendix is decidedly the most favorable and is the method which we are enabled to employ in cases of recurrent appendicitis with few exceptions. In cases of abscess the pus cavity, when limited, is thoroughly irrigated and drained with either tubes or iodoform gauze, or both combined. When the peritoneal cavity has become generally involved, irrigation and drainage are employed in the usual way.

After treatment.—The after treatment in acute cases consists in the administration of small doses of salines repeated sufficiently often to free the bowels, with the same diet as before mentioned, alimentation being allowed immediately on cessation of ether emesis.

THE NORMAL PRÆCORDIA IN INFANCY AND CHILDHOOD.

By H. B. Whitney,

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It is with great surprise that one finds how little attention has been given to the normal præcordial dullness in infants and children. Upon careful search through all the literature at my command I have failed to find more than two or three brief references to the subject, neither of which approximates to a full and careful statement of the facts. Weil, for instance, whose book on percussion is justly celebrated, simply says that in children below the age of 12 to 15 years the præcordial dullness extends more or less to the right of the right border of the sternum. Cutler and Garland copy the diagram of Weil. Henoch, Baginsky, and J. Lewis Smith give no intimation that the præcordia in childhood differs from that in the adult. Sansom, Fothergill, Loomis, and Guttman make no mention of children. Osler and Cheadle, in Keating's Cyclopædia, are likewise silent. The only author who seems to have given any careful study to the percussion of the heart in infancy is Rotch. In his article in Keating on Pericardial Effusions he states that in infancy the præcordia has the same boundaries as in the adult, while from the second or third up to the ninth or tenth year there is frequently some dullness over the lower half of the sternum.

That the subject merits attention it is hardly necessary to affirm. Endocarditis and pericarditis are not infrequent in childhood, and their diagnosis and differentiation by the aid of percussion depend, as in the adult, upon an accurate knowledge of normal percussion limits. In a child 3 years old a præcordial dullness reaching the second interspace above and extending an inch or more to the right of the median line should cause a strong suspicion of pericardial effusion or enlarged heart; in a child of 8 years such dullness would be normal. Certainly this is an important difference. Again, pleuritic effusions are common enough in childhood, and what more valuable diagnostic feature of effusion than displacement of the heart, particularly toward the right; and yet no diagnosis of slight displacement can possibly be made unless the normal percussion boundaries are known.

The interest of the writer in this subject was first aroused some years ago while

engaged in pædiatric work in Boston. The observation since that time of a comparatively large number of children whose præcordial areas have been for the most part carefully defined has led to the following conclusions:

In children up to the beginning of the sixth year of age the relative dullness of the normal heart has practically the same limits as in the adult, namely, above and to the left, a curved line extending from the junction of the third rib or interspace and sternum outward and downward to the apex of the heart in the fourth or fifth interspace near the mammary line. The right boundary (by far the most important, as being most variable in different pathological conditions) is a perpendicular line corresponding very nearly with the left border of the sternum. The lower half of the sternum is therefore of the same resonance as the upper half in children under 6 years of age.

From the fifth to the ninth year the præcordial dullness varies in different cases. In a few, even at 6 years, some slight dullness will be found over the lower half of the sternum, and in other respects also the præcordia appears to have begun to assume the characteristics presently to be described as peculiar to the latter half of childhood. While at the age of 5 years all cases examined by me presented what for convenience I will term the infantile præcordia, at 6 there were two infantile to every one enlarged. At 7 there was about an equal number of each. At 8 there were three enlarged to every two infantile. And at the age of 9 the infantile præcordia had entirely given place to the enlarged præcordia of the second half of childhood. We may say, then, that beginning with the age of 6 years the cases of infantile præcordia begin to disappear, and that this tendency gradually increases until at 9 years all cases are uniformly enlarged. During this period, therefore, the results of cardiac percussion must often prove equivocal.

In children over 8 years and up to about the age of puberty the limits of the normal præcordia are invariably found to differ widely from those of the first half of childhood and of adult life. In the first place the upper border is generally higher; it is often found as high as the second interspace and occasionally at the second rib. The apex is usually a little outside the median line, perhaps one-fourth to one-half inch. Of far greater significance and clinical importance is the position of the right border of the præcordial dullness. Instead of being a perpendicular line along the left sternal margin, it is now a curved line, which meets the line of liver dullness at a point outside the right sternal edge and usually 1¼ to 1½ inches to the right of the median line. This distance, of course, gradually diminishes as the upper boundary is approached. The præcordia now presents the form given in Weil's plate, and is somewhat similar to that found in cases of pericardial effusion in the adult.

Some points of importance should here be mentioned as regards the method of percussion. Light percussion only was used in obtaining the above results. A heavy stroke is rarely useful in adults and never in children, where it causes vibrations of distant parts and obscures the tone given by the tissues beneath the finger. Moreover, with the heft of the stroke the degree of accuracy, and especially of uniformity, is diminished. Again, the habit of marking upon the chest the exact point beneath the middle of the finger where the percussion note changes is by no means as puerile as might at first thought appear. Take, for instance, the upper border of a pleuritic effusion: When several marks, made at different points, unite to form a "letter of S" curve the surety of diagnosis is wonderfully increased. So with the heart; marks which lie along regular curves are quite sure to have a meaning. Furthermore, by percussion, first from the center of the præcordia toward the periphery and then backward from normal pulmonary resonance toward the center, it is easy to verify a line once drawn and to arrive at a high degree of certainty of result.

Still a third point of importance I have referred to in previous papers upon percussion of the heart in adults, but it can not be too often emphasized. In the

percussion, namely, of that portion of the heart which lies beneath the sternum, possible under normal conditions only, as already stated, in the second half of childhood, comparison should be made of the resonance of the lower half of the sternum, not with the normal pulmonary resonance along its right border nor with the cardiac flatness along its left, but with the resonance of its upper half, for the sternum is never quite as resonant as the adjoining chest wall; and in percussing from the præcordial center toward the right nipple one might readily suppose that the right border of the normal præcordia extended to the right sternal edge, since there for the first time a full tone is reached, while, on comparing the lower with the upper half of the sternum, it will often be found that the resonance of both is the same. To determine, therefore, whether the right limit of præcordial dullness extends beyond the left sternal border, its normal position in the adult, percussion should be made along the sternum from above downward as far as the horizontal line of hepatic flatness at the level of the sixth rib. Any encroachment of the præcordia upon this right angle formed by the left sternal border and the liver is, except in the latter half of childhood, pathological. It will have been observed that in the foregoing I have made no distinction between relative and absolute dullness. To the latter I attach comparatively little importance, and in speaking of præcordial boundaries I have always referred to the extreme outer limits of cardiac dullness beyond which there is full pulmonary resonance. In the enlarged præcordia of childhood the note elicited over the lower half of the sternum is not flat; it is only moderately dull, and the sense of resistance is but moderately increased. Anything approaching flatness in this region would properly cause suspicion of disease. At just what age this enlarged præcordia of childhood again becomes that of adult life I have been hitherto unable to determine satisfactorily, from lack of sufficient material. Weil, as before stated, says from the twelfth to the fifteenth year. It is an interesting question whether it may not in some cases exist still later than this, and thus cause a semblance of cardiac hypertrophy such as has been occasionally met with in very young men. I have seen several cases of enlarged præcordia in boys from 16 to 18 where there was no discoverable cause and, in fact, no other symptom of enlarged heart. The possibility above suggested should, perhaps, be borne in mind. It would be interesting, certainly, to inquire as to the cause of this comparatively sudden and very considerable increase in cardiac dullness at the seventh or eighth year of life, but I have neither space nor much to offer. Apparently it does not represent any actual enlargement of the heart, since Müller has shown by a series of careful observations that from birth to puberty the growth of the heart keeps about even pace with that of the body.

THE BACTERIOLOGICAL DIAGNOSIS OF DIPHTHERIA.

By H. C. ERNST, A. M., M. D., of Boston, Mass.

In presenting this paper upon the bacteriological diagnosis of diphtheria, I desire to say at the the outset that my object is not to bring forward anything original, but merely to emphasize the results of much experimental work, and to bring these results more prominently before the profession at large. To agree with the conclusions stated certain points must be considered as proven. These points are, first, that diphtheria is the process, characterized more especially by the formation of false membrane, which is the result of the activity of the Klebs-Löffler bacillus. That this point is settled, is, it seems to me, hardly open to dispute at the present time. Since the original experiments the evidence showing the pathogenic properties of the bacillus first seen by Klebs, and first studied under artificial conditions by Löffler, has increased so rapidly and has been of such positive nature as to leave no doubt upon the subject in the minds of those at all open to conviction. This

evidence bears not only upon the pathogenic properties of the bacillus in question, but upon its occurrence as well, so that it is now possible to assert that it not only occurs in diphtheria, but that it does not occur elsewhere as a factor in any other pathological change, and that, grown under artificial conditions in pure culture, it will, upon inoculation in pure culture in susceptible animals, produce a change in all respects resembling that from which it originally came; so that the complete chain of evidence connecting this organism with diphtheria as a causal factor is before us.

The second point, and quite as important as the first for our purposes, is this: That there occur, not infrequently, processes that do not differ clinically in any perceptible degree from those produced by the bacillus of diphtheria, that can not be distinguished from diphtheria by any ordinary means of observation, and that, nevertheless, are not diphtheria and have not the dangerous character of this disease, either for the one afflicted or for those exposed to the infection from it.

This is the gist of the whole matter, and its great importance will, I think, be very readily apparent, for if a patient be not affected with diphtheria, he should certainly not be exposed to the disease by being sent into a diphtheria ward, and vice versa, if he has diphtheria, even in so mild a form that the clinical diagnosis may be doubtful, he should not be allowed to escape a proper amount of isolation and care. That patients with clinical symptoms of diphtheria, but not really affected with it, are frequently unnecessarily exposed is sufficiently shown by numerous experiments. Martin (Ann. de l'Inst. Pasteur, 1892, p. 334), after the careful study of 200 cases sent to the diphtheria wards of the Children's Hospital in Paris, comes to the following conclusions, that the most expert clinician is deceived once in five times, either by considering a case diphtheria that is not so, or else by failing to recognize diphtheria when it is present. Koplik (N. Y. Med. Journ., August 27, 1892) and Park (N. Y. Med. Record, July 30 and August 6, 1892) bear out this assertion by the results of their elaborate investigations, and many observations of a less extensive character tend invariably to show the same thing, the impossibility of making an absolute diagnosis of diphtheria, even when false membrane is present, by ordinary clinical observation.

As to how many cases of mild diphtheria, without false membrane, escape detection, there is but little evidence. This from the nature of the problem is perfectly natural, for mild cases of throat trouble do not come under hospital observation, and experimental evidence must be obtained, as a rule, from hospital material. But it is evident that these mild, unwatched cases may easily be the most dangerous as foci of infection, and that, if there be any means for detecting them, these means should be generally known and employed. It is the purpose of this paper to explain what these means are and of what service they may be.

The series of papers by Roux and Yersin (Ann. de l'Inst. Past. T. II., p. 629; T. III., p. 273; T. IV., p. 385) are classics and first called general attention to the subject; Welch and Abbott (Bull. Johns Hopkins Hospital, 1891), Tangl (Arb. auf dem Gebiete der Path. Anat. und Bakt. aus dem Path. Institut zu Tubingen. Bd. I., Hft., I., s. 85), Baginsky (Berl. Klin. Woch. 1892, No. 9), Barbier (Rev. Mens des Maladies de l'Enfance, November, 1892), Heubner (Schmidt's Jahrbucher, CCXXXVI, 1892), Booker (Bull. Johns Hopkins Hospital, 1892), and Neumann (Deut. Med. Woch. 1893, No. 9), all furnish recent and important evidence, both as regards the weight of the evidence to be obtained and the methods by which it is to be sought. The evidence is of course the proof of the existence or non-existence of the bacillus of diphtheria in any given case; the methods by which this is to be determined are by microscopic observation, and by culture upon appropriate nutrient media of material obtained from the suspected locality.

The characteristics of the bacillus of diphtheria, so far as they concern the point in question, are as follows: It is a rod, either straight or slightly curved, with rounded ends, and having a diameter of 0.5 to 0.8 μ and from 2 to 3 μ in length. Irreg-

ular forms are very common, and especially in an unfavorable culture medium, very great differences in form and dimension may be observed; one or both ends may appear swollen, or the central portion may be notably thicker than the extremities, or the rod may be made up of spherical or oval segments. Multiplication occurs by fission only and the bacilli do not grow out into filaments. In unstained preparations certain portions of the rod, and especially the extremities, are observed to be more highly refractive than the remainder, and in stained preparations these highly refractive parts are seen to be most deeply colored.

The diphtheria bacillus may be stained by the use of Löffler's alkaline methylene blue (sat. alc. sol. meth. blue, 30 parts., aq. sol caustic potash (1–10000) 100 parts), but is not so readily stained with some of the other aniline colors commonly employed. It stains also by Gram's method. "For the demonstration of the bacillus in sections of diphtheritic membrane nothing can surpass in brilliancy and sharp differentiation sections stained doubly by the modified Weigert's fibrin stain and picrocarmine" (Welch and Abbott). The diphtheria bacillus is ærobic, non-motile, and non-liquefying; it does not form spores. It grows most freely in the presence of oxygen, but is also a facultative, anærobic organism. Development occurs in various culture media at a temperature of from 20°–42° C., the most favorable temperature being about 35° C. It grows rapidly in nutrient gelatine having a slightly alkaline reaction, in nutrient agar, glycerin agar, or in alkaline bouillon, but the most favorable medium appears to be the one first recommended by Löffler, viz, a mixture of three parts of blood serum with one part of bouillon added, the latter containing 1 per cent of peptone, 1 per cent of grape sugar, and one-half of 1 per cent of sodium chloride. This mixture is sterilized and solidified as is usual with blood serum. Upon it the development is so rapid in the incubating oven that at the end of twenty-four hours the large, round, elevated colonies of a grayish-white color and moist appearance may be easily recognized, while other associated bacteria will, as a rule, not yet have developed colonies sufficiently large to interfere with the recognition of these. (Sternberg's Bacteriology, p. 360.)

These are the facts in the case, not only that diphtheria is produced by a specific form of microörganism, but also that this microörganism is possessed of certain specific characteristics by means of which it may be isolated and identified in so short a time as to make this procedure of great value in the management of individual cases. The importance of carrying out the investigation lies in the fact that without it it is not possible to be certain of the diagnosis in single cases, as has been shown in every series that has been properly studied. The method by which this may be done that has been most commonly used is that of Roux and Yersin (Ann. de l'Institut Past. T., IV. p. 386) following Löffler (Mitt. a. d. Kais. Gesund., Bd. II) and consists of two parts, the microscopic and the culture examination. The examination by the microscope may be made as follows: A fragment of the false membrane is removed upon a tampon of absorbent cotton held in forceps or supported upon a handle of some kind. The membranous debris are pressed upon cover glasses in such a way that the part coming in contact with the cover glass shall be that from the false membrane and not the buccal surface. The covers dried and passed through the flame are colored, some with Löffler's methylene blue, and some with gentian violet and after Gram's method, then washed with water and examined, while still wet, with a homogeneous immersion lens. (Instead of Löffler's methylene blue, Roux and Yersin made use of a blue made up of dahlia violet and methyl green. This is prepared by mixing one part of a 1 per cent solution of violet in water with three parts of a 1 per cent watery solution of green, and adding enough water to make a clear deep blue. This color gives no precipitate and keeps for a long time. It is enough to put a drop of the stain upon the cover glass and then almost at once to place this upon the slide, soaking up the excess of stain with filter paper. The diphtheria baccilli are those that take up the stain most quickly and intensely.

Among all the other bacteria that may be present the diphtheria bacilli, not infrequently grouped together in little masses, appear as rods with ends somewhat narrowed and rounded, slightly curved, swollen in pear or club shape, granular, and irregularly stained. By Gram's method they are deeply stained. They are never absent in true diphtheria, and with a little practice they may be easily distinguished from the other bacteria. In certain severe cases they appear in almost pure culture, but ordinarily they are mixed with other varieties, although in looking over the preparations the little characteristic bunches of the rods may be seen. This procedure is extremely rapid and gives good results, but if one desires to establish the diagnosis as a matter of absolute certainty the bacillus must be isolated and pure cultures must be obtained. This can be done very easily and rapidly after Löffler's method by sowing the false membrane upon coagulated serum. This is so favorable a medium for the development of the diphtheria bacillus that the bacterium will show its characteristic colonies in less than twenty-four hours at 37° C., while the other bacteria have scarcely begun to develop. (The streptococcus, which is almost always present in false membranes, gives very small colonies upon serum, and these grow very slowly.) It is sufficient to break up the fragments of false membrane used for microscopic examination with a platinum spatula and to draw this over the surface of the serum two or three times in separate lines without recharging it. This spatula can be used for removing the material from the throat in the first place instead of the tampon of cotton. The false membrane should be gently scratched with it and it should then be drawn several times over the surface of the serum in several tubes. The tubes are then to be placed at a temperature of 37° C., and in less than twenty-four hours the diphtheria colonies can be clearly distinguished. They are round dull-white spots with a center darker than the periphery. They remain small in the first tubes, or part of the tube inoculated, because they are so crowded, but in those portions last sown they spread and increase in size, and in forty-eight hours have taken on a perfectly characteristic appearance.

The difference between tubes sown from true diphtheria and from cases simulating it is very marked after twenty-four hours at 37° C. In the former there appears a very large number of colonies all of precisely similar appearance and characteristics, while in the latter there very frequently occurs almost no growth at all. It is very rare that the other bacteria prevent the appearance of the characteristic diphtheria colonies. The colonies must be examined under the microscope as well, and must be shown to be made up of bacilli presenting the characteristics spoken of above. The more so because there is a micrococcus that presents colonies on serum at 37° C., after twenty-four hours, that answer in size and appearance to those of the true diphtheria bacillus, but which can, of course, be separated from them by the microscope. These cultures upon serum can also be very well made from dried false membrane, which can be softened in distilled water and then treated like fresh membranes, but much the better plan is to make the culture at the bedside, for in this way the chances of contamination are much diminished.

A source of error to be looked out for in this procedure is the occurrence of the pseudo-diphtheritic bacillus, an organism first described by Löffler himself, and which in its colonies and under the microscope resembles the true diphtheria bacillus so closely as to be indistinguishable from it. Its essential difference is that it is not pathogenic upon inoculation in pure culture, and as regards its interference with the rapid bacteriological diagnosis of diphtheria it may be disregarded. For, although it has been found to be widespread in the mouths of healthy children, nevertheless when it does occur it is present in very small numbers, so that the appearance of the tubes containing it is very different from that of those containing the numerous colonies of the true diphtheria bacillus. "In every case in which there is a notable number of colonies it can be concluded that diphtheria is present even before knowing the result of inoculations in animals; errors will be extremely rare." (Roux and Yersin., loc. cit., p. 413.)

For the reason that coagulated blood serum with the proper proportion of bouillon added is somewhat difficult to have continuously on hand, substitutes for this medium have been sought for in order to render the employment of this method of diagnosis more easy. It has been found impossible to suggest anything that is quite so good for the purpose as blood serum, but among the media that have been employed is egg albumin. This may be used, as suggested by Wyatt Johnston (Phil. Med. News, Dec. 10, 1892), by boiling an egg hard, which, of course, solidifies the albuminous contents and at the same time sterilizes the shell. There is prepared at the same time an ordinary egg cup, which may be sterilized by burning a little alcohol in its hollow. A small portion of the shell of the egg is then chipped off at one end, and a minute portion of material from the throat of the suspected case is drawn over it with a platinum needle in the same manner as before described. The egg is then inverted in the egg cup and the whole placed in a warm place over night. This, however, is but a modification of the method of using this material suggested by Sakharoff (Ann. de l'Inst. Past., T. VI, 1892, No. 6), by which the eggs, after being boiled hard, are opened, the albumin is sliced in pieces of convenient size, placed in sterilized test tubes with a few drops of water to retain the moisture, and cultures are made upon the slices of solidified albumin in the same manner as upon blood serum.

This, then, is the manner in which the diagnosis may be made, the procedures necessary being the inoculation of a favorable nutrient medium with material from a suspected case and the keeping of these cultures at a temperature of 37° C. for twenty-four hours. The points in the diagnosis are the rapid growth of the colonies at this temperature, outstripping that of almost all other bacteria, the physical characteristics of these colonies thus grown, and the appearance, under the microscope, of the bacteria of which they are made up, as well as the behavior of these bacteria to the aniline colors.

I have had made a case that appears to me to fulfill the requirements of this method of diagnosis. It contains two test tubes with nutrient media, two glass rods with platinum needles inserted at one end, and a box for holding cover glasses. A pair of forceps was not included in the case, for it would have added to the expense, and forceps are to be found in every physician's bag, and can be used and sterilized and used again, if necessary, for a series of cases, while the case contains only what is necessary for a single case.

The importance of this method of diagnosis has been already recognized by the New York Board of Health, which has recently issued a circular calling attention to it and offering to carry it out in all cases, and the recent results reported show that by this test fully one-third of the cases sent to the Willard Parker Hospital were cases of false diphtheria, that is, did not show the diphtheria bacillus upon investigation (N. Y. Med. Journ., Aug. 26, 1893).

The impossibility of separating croup and diphtheria, from an etiological point of view, is shown by such work as that of Concetti (Arch. Italiano di Pediatria, X, 1892), who failed to find the bacilli only twice in sixteen cases of croup examined. Escherich (Cent. f. Bakt. Bd. VII, s. 8), Wurtz, and Bourges (Cent. f. Bakt. Bd. VIII, s. 301), and lately Welch and Councilman (Trans. Mass. Med. Soc. 1893), seem to show that, in certain cases at least, the inflammations of the throat occurring in scarlet fever are of diphtheritic origin. Baginsky (Arch. f. Kinderheilkunde, Bd. XIII, s. 418) examined 93 cases of suspected diphtheria, in 68 of which he found the bacillus of diphtheria. Among these 68 cases there were 27 deaths (40 per cent), while there was but 1 death in the 25 cases in which the bacillus was not found, and this point of the far greater mortality from true diphtheria than from false has been emphasized by many others as well. He also lays stress upon the diagnosis in what he calls "scarlatinal diphtheria."

Tobiesen (Cent. f. Bakt. Bd. XII, 1892, No. 17) attempted to determine the length of time that the bacillus of diphtheria would persist in the throats of convalescents,

and found it in 24 cases out of 46 examined for varying lengths of time, extending from four days to, in one instance, thirty-one days after the swelling had gone. With cultures from 19 out of these 24 cases inoculation experiments were made, with positive results in all of them, thus proving the continued virulence of the organism. These references, with many others that might be made, show with great distinctness the problems that can be settled in cases of suspected diphtheria by bacteriological examination, but the especial point that it has been my desire to emphasize before such an audience as this is the value of the procedure for diagnostic use.

SUR LA MALARIA CHEZ LES ENFANTS A RIO DE JANEIRO.

Par le Docteur MONCORVO,

Membre correspondant de l'Académie de Médecine de Paris.

Aussitôt que je me suis consacré à l'étude et à la pratique de la clinique pédiatrique à Rio, je ne tardai guère à me rendre compte de la remarquable fréquence de la malaria au milieu des diverses entités morbides dont y sont affectés les enfants de tout âge. Elle est à coup sûr, après la syphilis héréditaire, la maladie prédominante dans le tableau de notre pathologie infantile.

Les quelques remarques qui vont suivre à son propos ont pour base un stock d'environ 5,000 cas de malaria aiguë, sub-aiguë ou chronique observés chez des sujets appartenant à toutes les périodes de l'enfance.

Pour donner une idée de sa fréquence il me suffira de reproduire ici le relevé statistique des faits de cette nature enregistrés dans mon service au cours des deux dernières années (1891–1892).

	1891.	1892.	Total.
Total des cas	633	765	1,398
Cas de malaria	242	271	513

D'après ces chiffres la malaria se montre dans une proportion de 36 pour cent environ, par rapport aux autres maladies de l'enfance.

En envisageant ces 513 cas de malaria d'après la période de l'enfance où ils ont fait leur apparition, on les trouvera répartis de la façon suivante:

	1891.	1892.	Total.
De 0 à 3 mois	37	41	78
De 3 mois à 1 an	55	65	120
De 1 à 2 ans	56	62	118
De 2 à 7 ans	52	76	128
De 7 à 15 ans	42	27	69
Total	242	271	513

Il en ressort ainsi la prédilection marquée de la malaria pour la première année de la vie; au fait, sur les 513 cas recueillis au cours de deux années, on compte 198 observés pendant cette époque de l'enfance, soit environ 35 pour cent.

Vient en deuxième rang la période comprise entre 2 et 7 ans, soit 25 pour cent sur le total des cas.

Comment expliquer cette prédominance du mal chez les sujets du premier âge? Tiendra-t-elle au vice du régime alimentaire?

Le relevé statistique des cas où on a pu enregistrer le genre d'alaitement m'a permis de dresser sous ce rapport le tableau suivant:

	1891.	1892.	Total.
Allaitement maternel	79	104	183
Allaitement artificiel	54	49	103
Allaitement mixte	53	16	69

Il est facile de voir après cela qu'il n'y a guère lieu d'incriminer les écarts du régime comme étant la condition primordiale de la plus grande réceptivité des petits sujets. Il va sans dire que toute entrave à la nutrition, quelle que soit son origine, ajoutée à l'état encore rudimentaire de l'organisme infantil, ne pourra manquer de le prédisposer à tout genre d'infections.

L'activité exagérée des voies d'absorption à cette phase de la vie semble contribuer pour une plus large part à la pénétration du germe malarien.

Une condition particulière de la composition du suc gastrique des jeunes enfants, notamment des nouveau-nés, paraît agir conjointement pour leur plus grande réceptivité à la malaria.

Mes recherches publiées, en 1889, au sujet de la sécrétion gastrique des petits sujets montrent en effet que de la naissance à la fin de la deuxième année l'insuffisance gastrique est presque invariablement due au déficit ou à l'absence de l'acide libre du suc gastrique.

On connaît bien aujourd'hui la faculté que possède le suc gastrique normal de détruire ou d'atténuer la virulence des germes introduits dans la cavité stomacale. Cette composition encore imparfaite du suc gastrique des jeunes sujets les prive de la sorte de ce moyen défensif si utile chez les adultes à l'état sain.

D'ailleurs, l'aptitude des petits enfants aux refroidissements d'une part, et l'activité sécrétoire exagérée de leurs glandes sudorales pendant nos longues saisons estivales d'autre part, concourrent à en augmenter la prédisposition à contracter la malaria.

Les distrophies héréditaires en amenant l'abaissement de la résistance organique ne laissent pas moins de jouer un rôle assez important par rapport à l'accroissement de cette réceptivité. D'après mes observations, la syphilis y figure au premier rang; c'est ainsi que sur un total de 513 enfants atteints de malaria on retrouve chez 209 les signes avérés de la vérole congénitale, ce qui donne une proportion de 39 pour cent.

C'est à peine si dix de ces enfants portaient conjointement des traces de tuberculose. Il découle en somme de mes observations personnelles que les sujets du premier âge présentent une bien plus grande aptitude à contracter la malaria que ceux ayant dépassé cette période de l'enfance, ce qui est d'accord avec l'observation de presque tous les pédiatres, encore même de ceux qui exercent aux climats absolument différents du nôtre.

Il n'y a rien de particulier à dire en ce qui regarde le sexe. Au fait, sur les 513 cas de malaria, 274 appartenaient au sexe masculin, 239 au sexe féminin, ce qui donne au premier une médiocre majorité de 35 cas.

En ce qui concerne les races les cas en question se répartissent comme il suit:

	1891.	1892.	Total.
Blancs	159	187	346
Métis	61	64	125
Nègres	22	20	42
Total	242	271	513

Ces chiffres qui expriment à peu près la moyenne de mon stock d'observations de malaria semblent indiquer un certain degré d'immunité des enfants de race noire pour cette sorte d'infection.

Il paraît qu'on n'avait songé jusqu'ici à la rechercher.

La presque totalité des petits malades compris dans mon relevé était nés à Rio ou en d'autres villes du pays; 482 étaient en effet brésiliens, 14 portugais, 14 espagnols et 3 argentins.

Ils se trouvent d'ailleurs ainsi partagés par rapport à leurs habitations:

	1891.	1892.	Total.
Cité commerciale	81	54	135
Faubourgs et quartiers ouvriers	103	161	264
Quartiers environnant la partie centrale	58	56	114
Total	242	271	513

On voit d'après cela que la classe moins aisée de Rio fournit le plus grand contingent d'enfants atteints de malaria.

Mes 513 cas de malaria infantile se montrèrent au cours des différents mois dans la proportion qui suit:

	1891.	1892.	Total.		1891.	1892.	Total.
Janvier	25	23	48	Août	12	32	44
Février	31	28	59	Septembre	10	24	34
Mars	34	32	66	Octobre	19	27	46
Avril	29	12	41	Novembre	14	19	33
Mai	20	23	43	Décembre	22	17	39
Juin	10	18	28				
Juillet	16	16	32	Total	242	271	513

Ces chiffres démontrent la plus forte proportion des cas pendant les trois premiers mois de chaque année, c'est-à-dire ceux les plus chauds de notre saison d'été, le mois de mars étant celui qui fournit le contingent le plus élevé.

On y voit par contre baisser à 60 le chiffre des cas au cours des mois de juin et juillet, ceux précisément les plus froids de notre courte saison d'hiver.

La hausse ou la baisse de la chaleur atmosphérique exercent donc une influence indéniable sur l'accroissement ou la rareté des faits de cette nature au tableau de la pathologie infantile à Rio.

J'ajouterai ensuite quelques remarques concernant les allures particulières que revêt la malaria chez les jeunes sujets.

D'une façon générale: invasion insidieuse, notamment chez les nouveau-nés; symptômes initiaux vagues, mal définis, restant souvent inaperçus aux yeux des parents; agitation nocturne, insomnie, soif, refroidissement plus ou moins accusé des extrémités, pâleur du visage, des pleurs fréquents sans motif apparent, parfois encore une transpiration générale ou partielle (notamment à la tête).

A côté de ces manifestations à peu près banales, il est très commun de voir un changement de l'aspect et de la composition des selles, lesquelles se répètent tout en devenant grumeleuses, verdâtres, panachées, séreuses ou séro-bilieuses, d'une odeur acide ou fétide.

Elles sont alors presque souvent précédées, accompagnées ou suivies de coliques, parfois d'une très vive intensité, de même que du ballonnement du ventre.

Lorsque le petit patient n'a point encore atteint l'époque probable de la dentition pour qu'on pense à lui rattacher cette diarrhée, ses parents n'hésitent presque jamais à la rapporter à quelque cause d'ordre alimentaire, encore même que l'enfant soit nourri au sein par sa mère ou par une bonne nourrice.

Le petit malade maigrit à vue d'œil, pâlit davantage, devient très grognon, en même temps que la chaleur fébrile s'élève alors suffisamment pour attirer l'attention des personnes de son entourage.

La fièvre revêt presque souvent dans ces cas un type rémittent des plus irréguliers, entremêlé parfois de courtes intermittences dont les maxima varient toujours, ce qui m'a fait qualifier dès longtemps d'anarchique le type de la fièvre malarienne dans l'enfance et plus particulièrement chez les nouveau-nés.

Si le mal n'est point entravé de suite, ou si on ne lui oppose qu'une défense médiocre, on ne tarde guère de voir la situation de plus en plus s'aggraver; les traits de l'enfant s'altèrent, la soif augmente, l'intolérance gastrique se déclare, la diurèse diminue, l'agitation s'accroît progressivement, bref des convulsions éclatent et le dénouement fatal ne se fait pas attendre. L'acuité de la marche ainsi que la gravité menaçante de l'empoisonnement malarien deviennent moins redoutables au fur et à mesure que l'enfant s'éloigne du premier âge, mais ce début obscur, d'une bénignité souvent trompeuse, l'anarchie du cycle fébrile, cette banalité des manifestations initiales ne laissent pas moins de constituer aussi en quelque sorte les traits caractéristiques de l'empoisonnement malarien chez les enfants ayant déjà dépassé la deuxième année.

Les symptômes nerveux, d'une exceptionnelle gravité au cours de la première année, deviennent graduellement moins fréquents et moins dangereux chez les enfants plus avancés en âge.

Les complications cérébro-médullaires, méningitiques broncho-pulmonaires, gastro-intestinales, rénales, isolées ou combinées, viennent très souvent obscurcir au plus haut degré les signes propres à l'empoisonnement primitif.

Ces localisations viscérales, qui d'après nos connaissances bactériologiques actuelles ne sont autres que le résultat d'une infection secondaire, m'avaient conduit à établir plusieurs formes cliniques de la fièvre malarienne telles que: forme cérebrale, méningitique, medullaire, gastro-intestinale, rénale, etc.

Autour de ces types principaux se groupent les formes larvées, d'une fréquence peut-être plus grande chez les jeunes sujets qu'à l'âge adulte.

Leur description détaillée prendrait ici trop de place; la syncope, le vertige, l'étourdissement, la céphalée, le sommeil, la dyspnée d'origine centrale, la tachicardie, les points de côté, les gastralgies, les vomissements, les entéralgies, les hepatalgies, les splénalgies, les cystalgies, les polyuries, les spasmes vésicaux, etc., voilà autant de phénomènes qui s'imposent par leur intensité ou par les souffrances qu'ils amènent.

Il est bien à remarquer que chez les enfants, notamment chez ceux du premier âge, l'accès de fièvre malarienne ne se composent, ainsi qu'il arrive à l'âge adulte, des trois stades de frisson, chaleur et sueur. Le frisson fait toujours défaut chez les premiers; à sa place il y a presque souvent lieu de constater l'hypothermie périphérique ou, dans quelques cas plus rares, le refroidissement général de la surface cutanée accompagnée de sueurs froides et d'adynamie. Dans d'autres cas l'accès débute par l'élévation de la chaleur, la peau restant jusqu'à la fin absolument sèche. Le stade de sueur qui peut précéder ou suivre l'accroissement de la chaleur constitue parfois la seule manifestation de l'accès.

Les accès prennent donc dans l'enfance des allures spéciales qu'il faut bien connaître pour éviter des méprises fâcheuses. Une autre particularité aussi digne de note est l'absence fréquente, dans le jeune âge, de l'hyperémie hépatique et plus souvent encore de celle de la rate. Il faut toujours compter sur cette variabilité séméiologique, sur cette véritable anarchie de types et de formes que revêt la malaria aiguë à cette époque de la vie.

La déchéance organique en est la conséquence immédiate, elle se traduit par l'amaigrissement et par la perte du poids. En pesant presque souvent mes petits malariens jai été ainsi à même de les voir perdre de 100 à 500 grammes dans l'espace d'une semaine.

L'examen des urines dénonce souvent chez eux la présence de peptone de même que le taux des phosphates et des urates au-dessus de la moyenne normale. Dans quelques cas moins fréquents l'albumine s'y montre dans des proportions variables. Jamais il ne m'a été donné d'y retrouver la présence de glycose.

Les formes chroniques, apyrétiques se traduisent plus particulièrement par le ralentissement de la nutrition, par l'anémie, par la dyspepsie, la dilatation de l'estomac, la diarrhée lientérique, l'hypertrophie de la rate ou du foie, isolés ou associés, par le changement du caractère, l'état nerveux, l'insomnie, le retardement intellectuel. Parfois, l'organisme de l'enfant arrive à un degré extrême de dystrophie, que j'ai désignée sous le nom de phthisie malarienne.

Il est très commun alors de voir la maigreur squelettique du thorax et des membres contraster sensiblement avec le ballonnement considérable du ventre, ce qui les rend comparables en apparence aux petits sujets atteints de carreau.

Cette ressemblance a donné souvent lieu à des regrettables erreurs de diagnostic, ainsi que je l'ai à plusieurs reprises signalé dans mes cliniques. L'examen du sang dans le but de découvrir les hématozoaires de Laveran, souvent répété par Moncorvo fils, chargé des travaux bactériologiques dans mon laboratoire, n'ont donné jusqu'ici des résultats satisfaisants, nonobstant l'emploi rigoureux de la technique adoptée par Laveran, Romanowsky, Roux et Gram.

Le diagnostic de la malaria n'est point toujours facile. Chez les jeunes sujets l'intoxication se prête souvent à la confusion avec les formes aiguës de la tuberculose. L'embarras augmente davantage lorsque les deux états morbides coexistent, ce qui n'est pas rare chez nous.

Il faut toujours se méfier de tout état morbide mal défini qu'on ne puisse rattacher à une cause bien avérée.

La malaria restant souvent latente pendant un temps indéterminé peut éclater sous l'influence de causes les plus diverses; une chute, une vive émotion, la peur, un refroidissement, un traumatisme, une opération chirurgicale, ou enfin l'invasion d'une autre maladie infectieuse, telle que la rougeole, la scarlatine, la variole, etc.

C'est pour cela que je ne cesse de répéter à mes élèves ce précepte dont ils doivent tenir toujours compte. Méfiez-vous toujours de la malaria auprès d'un enfant malade à Rio; et j'ajouterai qu'il faut dans quelques cas la soupçonner car elle se cache parfois à nos moyens ordinaires pour la découvrir.

Pour que la gravité de la malaria dépasse toujours celle des autres âges, il ne faut jamais oublier qu'une intervention thérapeutique puissante venue à temps peut triompher des cas paraissant même au-dessus des ressources de l'art.

Il faut que le mal soit reconnu à son début et que la thérapeutique agisse de suite avec l'activité et l'énergie désirables.

La quinine doit être donc administrée à des doses proportionnelles à la gravité du cas et pas exclusivement à l'âge du petit malade.

L'organisme infantil tolère bien mieux la quinine que celui des adultes; l'activité de ses emonctoires, notamment de l'appareil rénal, en facilite beaucoup l'élimination.

Son amertume la rend pourtant d'une administration peu commode par la voie gastrique; les enfants la rejettent facilement en faisant perdre de la sorte un temps précieux.

Il ne faut compter d'autre part sur son introduction par la voie rectale, les lavements étant fort mal supportés par ceux-là.

Il y a encore des médecins qui recourent aux frictions cutanées d'une pommade ou d'une solution vinaigrée ou alcoolique d'un sel de quinine.

C'est là une méthode infidèle qui aurait dû être abandonnée dès que Briquet a suffisamment démontré, par des expériences jamais contestées, que l'absorption de la quinine est à peu près nulle par la voie cutanée.

Celle la plus sûre, notamment lorsque le cas est pressant, c'est sans contredit la voie hypodermique. J'ai été le premier à l'introduire dès 1874 dans la thérapeutique infantile.

Je me servai d'abord pour cela du sulfate basique de quinine dissous à l'aide de l'acide tartrique. Plus tard je m'adressai de préférence au bisulfate; enfin depuis ces dernières années je me suis arrêté au bichlorhydrate de quinine, celui-ci renfermant la plus forte proportion d'alcaloïde tout en étant d'ailleurs d'une extrême solubilité.

En m'entourant des plus rigoureuses précautions aseptiques je pratique à une très vaste échelle les injections hypodermiques de quinine sans en observer des accidents; j'introduis profondément la canule jusqu'à la surface musculaire, en rendant de la sorte moins douloureuse la pénétration du liquide injecté qui est d'ailleurs plus activement absorbé.

Les régions préférées sont la rétro-trochantérienne et l'inter-scapulaire.

Les doses varient, d'après l'intensité de l'infection, de 25 centigrammes jusqu'à 3 et 4 grammes dans la journée.

Lorsque je parviens à l'administration de doses quelque peu élevées de quinine, j'en neutralise l'action dépressive au moyen de la caféine que j'introduisis, dès 1888, dans la thérapeutique infantile, en l'employant par la voie hypodermique.

Elle agit comme un stimulant du système nerveux central tout en activant favorablement la sécrétion rénale.

Par son action tonique du cœur elle prévient les accidents à redouter du côté de cet organe lorsqu'une hyperthermie prolongée en menace l'intégrité anatomique et fonctionnelle.

Je viens tout dernièrement de communiquer à la Société de Thérapeutique de Paris un extrait de mes recherches sur le traitement de la malaria infantile, par une plante de la famille des synantherées, *l'helianthus annuus* ou tourne-sol.

La teinture alcoolique et l'extrait des diverses parties de la plante essayés sur plus d'une centaine d'enfants m'ont fourni jusqu'ici des résultats assez encourageants.

Le bleu de méthylène que j'essaye depuis l'année dernière, à la dose journalière de 15 à 40 centigrammes, mérite aussi d'attirer l'attention des pédiatres.

A côté de sa parfaite inocuité m'a-t-il donné déjà des résultats assez satisfaisants. *L'helianthus annuus* ainsi que le bleu de méthylène peuvent être bien profités pour les cas moins graves, sa saveur presque nulle rendant plus facile leur administration aux petits sujets.

Le traitement actif maintenu sans relâche parvient très souvent à triompher des cas les plus redoutables; cela dépend de son opportunité, laquelle suppose du reste un diagnostic porté sans le moindre retard.

Cette grande énergie d'action explique peut-être la mortalité absolument exceptionnelle dans mon service, où on a enregistré 14 décès par malaria en 1891, et 8 en 1892, au total 22, soit la proportion minime de 4 pour cent.

PHYSICAL TRAINING OF SCHOOL CHILDREN.

By J. GARDINER SMITH, of New York.

The members of this congress, and especially of this section, have to do largely with individuals of school age. The school boys and school girls represent a large proportion of our respective communities. Whatever contributes to their welfare in mind or body appeals at once to our interest. Strong, healthy, educated men and women the world needs to-day and our meeting is to discuss ways and means of accomplishing this end. Therefore this topic is recognized by this body. We have to deal with these children through boards of education or private corporations, which in many towns are slow to believe in the necessity of the expenditure attending properly conducted physical training. To accomplish much we must urge progressive measures through the board of health or otherwise for the betterment of the bodily training of these children. The need is apparent. Scholars are taught words and facts and figures; their cerebral centers engorged with blood at the

expense of bodily growth and development. Teachers wonder why the young mind does not show more energy, why it does not grasp and retain and digest all this mental food. The fact is forgotten that the voluntary muscles contain perhaps one-fourth of the blood in the body and that through their activity a large proportion of the potential energy of the body is changed into work and heat. Springtime comes, and the pale face indicates the lack of recreative muscular exertion. (At this time the term malaria covers a multitude of sins of ignorance.) Such exertion is needed not alone to stimulate the growth of muscle, but to set free that energy which stimulates the growth of the mind.

As a pedagogic measure, physical exercise, properly directed, is decidedly important. One need but observe the standing or sitting position of school children, their awkward gait, difficult breathing when singing or speaking, to appreciate this fact. Kindergarten for the very young and manual training for older scholars aims to give the child better control of the muscles, more acute perception and judgment of external objects, besides practical knowledge. Now the main effects of exercise upon a single muscle (as Dr. Hartwell remarks in Hare's Therapeutics) are growth or increase in size and probably number of its structural elements, increased facility in its functional activity, and better response to central nervous stimuli. Secondarily, kindergarten and manual training, to a limited extent, effect both muscle and mind. But the need to-day is a definite system of physical training which, by graded and more or less intricate exercises shall not merely develop muscle, but educate the mind to control and coördinate the whole voluntary muscular system. For, as Dr. Keating says in his Cyclopædia of Children's Diseases, "every movement of the body depends as much upon the proper coördination of the muscles for its accuracy, grace, and force, as upon the strength of their contraction."

The need of physical training as a hygienic measure is more imperative or at least more apparent. During the past two years I have examined upward of 2,000 public school children. A large proportion stood with abdomen protruding, shoulders and neck forward. The average expansion of the chest at the nipple was, boys, 1.1 inches; girls, 0.9 inch. The breathing was sufficient to support life, but the quantity of complemental and reserve air was very small. Very few could distinguish between diaphragmatic and costal breathing. About 10 per cent had an apparent scoliosis. Comparatively few rachitic children were found. Nearly all were right-handed. The step in most cases was fairly good, as the children had already been trained in marching.

After eight months of training, boy's chest expansion averaged 1.9 inches, a gain of 0.8 inch, and girls averaged 1.8 inches, a gain of 0.9 inch. Scoliosis had improved in 80 per cent of the cases. These examinations showed a most urgent need of training in the sitting and standing position, in development of muscles of trunk and upper extremities, and especially in the carriage of the body and mobility of the chest. It is well known that the circumference of the chest, together with the height and weight are factors that determine the capacity of the individual for military, naval, and other public duties. The chest expansion of boys and girls differs less in early years than later, largely on account of dress. Their bodies can be moulded and their proportions changed between 5 and 15 years as at no other. For all these reasons and many more, it is highly imperative that a rational system of physical training be pursued during these ages. Such a system should meet the demands—hygienic, educational, and recreative.

Question.—The practical question now arises, as to the method and its adaptation. Shall the system be German or Swedish, or what? Shall the teachers be alopaths or homœpaths, or what? I say let the system be American, comprising the best of all known exercises. Let the teachers be "regulars," well informed upon all the so-called systems, thoroughly familiar with the human body, able to examine the scholars and adapt the exercises to their needs. Too much time is spent to-day discussing systems, and too little in the study of needs and how to meet them.

Professor Ling compiled some exercises for the sick, and now the Swedes have an elaborate arbitrary system of exersises for sick and well. Father Jahn introduced some exercises to make better soldiers, and now the German Turners are known far and wide. M. Delsarte outlined a series of exercises for expression in oratory. His idea never was a system of gymnastics and should not be so construed. The colleges and Young Men's Christian Associations have adhered to no special so called system. What then should be the system of physical training of children in our schools?

Method.—As to the method, it must vary in detail according to circumstances. We must consider the condition and needs of the children first. This may be done by some form of physical examination. The heart, the lungs, the thoracic cavity, the condition of bones, of trunk, and limbs, the strength and development of the voluntary muscles should be noted and considered. Measurements of height, weight, chest, abdomen, hips, arms, and other important notes should be recorded. In this way the director of this department is enabled to place the children in proper classes, and to arrange and adapt the work intelligently. On the other hand, the children are thus stimulated to work for their physical improvement, and not merely to learn and perform certain mechanical exercises, with no definite end in view. Next we must consider the building, the room or rooms to be used, the number of teachers and number of grades, the length of time spent in each grade, the sex of the grades, the apparatus available. Next we must consider the mental capabilities of the children and suit the exercises to the various grades from this standpoint also. The system must be progressive from the A B C to the graduate who enters college or business. In this progression, however, fun and recreation should always be prevalent. The demands of hygiene, education, and recreation should underline the whole system. There are two other very practical considerations: first, the coöperation of the regular teachers, and second, the financial outlay. This latter need not be very extensive, although it should be sufficient to secure the best talent and best effort. One competent man with coöperation of the regular teachers might have the oversight of from 5,000 to 20,000 pupils, or with special assistants he might direct an almost unlimited work. I have been agreeably surprised to see the unanimous and hearty way in which principals and teachers have supported physical training in the schools of New York City.

With these facts before us we proceed to a more definite outline of exercises. Those permissible in school may be classified as follows:

For all, training in sitting position; training in standing position; breathing—upper thoracic, lower thoracic, diaphragmatic; marching, walking, running, hopping, skipping, jumping.

Lower grades, calisthenic exercises (innumerable) without apparatus.

Middle and upper grades, gymnastic exercises with apparatus, rings, dumb-bells, wands, Indian clubs, poles, bell bar.

Upper grade, heavy gymnastic exercises; horse, buck, parallel bar, horizontal bar, vaulting, jumping, ladders, rings, etc.

For all, games indoors and out. Innumerable games, especially in spring and fall, with much of the other exercise can be done and should be done out of doors.

It is not necessary to go into much detail regarding this classification, but some explanation may be profitable.

Assuming that we have a room well ventilated, with 200 cubic feet of air space for each individual and the most modern adjustable desks and seats, there are innumerable groups of enjoyable exercise which might be done by the children as often as every half hour at least. Motion is one of the means of rest to the growing child. He should not be restrained in one position longer than five or ten minutes. Neither should faulty positions tending to scoliosis and other deformities be permitted. Exercises in the sitting position may be alternated with risings, and facings, and marchings at intervals. This rest and recreation for body and mind need not be longer than one minute or two, or perhaps five.

Standing.—Before children are taught to march they should be taught to stand in the position of the soldier (see Revised Tactics, U. S. Army). Ask the untrained child to sit or stand erect and you will observe the shoulders thrown backward, head tipped back, and abdomen protruded in many if not all cases. Considerable training will be necessary to properly "set up" the child.

Breathing.—Perhaps the next most important point is control of the thoracic muscles, both for the health of the child and to improve his singing and speaking. He should be taught to use upper and lower thorax and diaphragm at once and each separately. These ideas inculcated into the minds of children might do much to inaugurate dress reform, because the child could see the impossibility of sufficient chest expansion with the chest constricted.

Marching.—Many evolutions in accordance with the United States Army tactics will prove interesting and beneficial to the scholar and to the school and will give us better men and women and better soldiers.

Calisthenics.—This field is almost unlimited where large, airy rooms are at command. In many schoolhouses calisthenics must be limited to such as can be done in a class room full of desks. It must be remembered, as Dr. Lincoln remarks in his article on school hygiene in Dr. Keating's Cyclopædia, "Above the age of 12 scholars begin to look down on free or calisthenic exercises as childish, and with good reason, for they lack one essential element, they do not call for exertion to overcome resistance. For better work scholars should have light dumb-bells, wands," etc. I would note another lacking element, viz, the recreation afforded by the fact of some apparatus held in the hand and used in the exercise. We see this desire for apparatus before the child reaches 12 years, and in New York City five primary grades use light apparatus. Calisthenic exercises may be grouped in drills for assembly or class room or gymnasium, occupying from one to twenty minutes. The progression proposed by Professor Ling, the grace and ease of expression as taught by Delsarte, and the recreative "rounds" of the Germans can be made exceedingly attractive when adopted to the needs of the scholars. The United States Army "setting up" drill, arranged to 4-4 time, has proved a very interesting and attractive assembly and class room drill.

Light gymnastic exercise (with apparatus) affords better opportunity to grade the exercise to suit the body and mind of the child of 5 and of 20 years; to cultivate not alone muscle, strength, grace, and agility, but to train the memory, perception, judgment, and almost every faculty of the mind, at the same time affording much recreation. Indian-club swinging, for instance, while simple and easy, can be made most intricate and interesting. This fact was illustrated at one of our New York school receptions, where the graduating girls gave a very creditable exhibition of club swinging, as shown in the grace of movement, complexity, and variety of exercise. The following is a classification of the graded drills used in New York City schools for the year ending June 30, 1893:

In grammar department: First grade, advanced Indian-club drill, No. 1; second grade, advanced bell-bar drill, No. 1; third grade, wood dumb-bell drill, No. 1; fourth grade, bell-bar drill No. 2; fifth grade, wood dumb-bell drill, No. 2; sixth grade, short-wand drill, No. 1; seventh grade, wood dumb-bell drill, No. 3; eight; grade, calisthenic dumb-bell drill, No. 4.

For the primary departments: First grade, Indian-club drill, No. 2; second grade, anvil-chorus dumb-bell drill; third grade, short-wand drill, No. 2; fourth grade, wood dumb-bell drill, No. 5; fifth grade, ring drill, No. 1; sixth grade, calisthenic drills, Nos. 1 and 2.

In the higher grades, where the ages range from 11 to 17 years, especially in the male department, heavy apparatus, such as horse, horizontal bar, etc., can be used to advantage. This work need not be limited to the boys' classes, though of course the work by the girls must be much simpler and easier of accomplishment. The element of resistance to exertion with this apparatus satisfies an evident demand and affords an increased amount of recreation. Here the class should work in squads

under competent leaders, who set the exercises and see that they are properly executed.

Games.—Of course the element of fun is greatest in the so-called "games." The rivalry and exertion completely changes the mental condition and recreates body and mind. These should not be carried to fatigue. Baseball, handball, basket ball, tag, etc., can be utilized in a most profitable way. Games will, I believe, hold a much more prominent place in the future than to-day in school-association and college gymnastics.

How taught.—In answer to this question we would say by the class teacher directly. Of course a director with medical and gymnastic training should outline and have the oversight of all this work. It does not necessarily follow that the teacher must in all cases be able to execute the exercise before the class, though this ought to be possible in most instances. If not there are always to be found natural leaders who will act under the teacher's direction. This plan has been followed in New York for two years with good results. The director of physical training should visit each school at intervals (perhaps once each week), reviewing the past work and setting some new exercises for each class. The exercises of each grade should be printed, and may be illustrated by photographs and placed in the hands of the teachers. The assembly work and marching orders will be about the same for all classes, but the grade work of course will vary in progression. When the exercises are well understood by the scholars, the piano or other music increases the interest and recreation of the work, and need be the only leader of the class. The exercises taught by the class teacher will prove mutually beneficial.

The reports of principals upon physical training in the New York City schools last year was universally favorable, and the demand there is for more money and more facilities for exercise. In Boston, Chicago, Kansas City, St. Louis, Washington, and a few other cities, physical training is being pursued with favorable report.

CONTRIBUIÇÃO PARA O ESTUDO DOS CORRIMENTOS BLENNORRHAGICOS NA INFANCIA.

Por MONCORVO, FILHO.

Assistente do Laboratorio de Biologia do Estado, Chefe de Clinica do Serviço de Pediatria da Policlinica do Rio, Membro effectivo do Gremio dos Internos dos Hospitaes, Bibliothecario do mesmo Gremio, Socio fundador da Sociedade Nacional de Acclimação, etc.

D'entre os muitos casos clinicos interessantes, em que tenho baseado as minhas investigações bacteriologicas no serviço de pediatria do Prof. Moncorvo, alguns casos de blennorrhagia em crianças de pouca edade hão chamado particularmente a minha attenção.

Sete doentes de vulvo-vaginites blennorrhagicas, das quaes uma affectada de rheumatismo blennorrhagico e outras duas de conjunctivite tambem da mesma origem, foram de preferencia designadas pelo chefe do serviço para a confirmação microscopica. A edade d'estas doentes variava de 0 á 11 annos, notando-se que a doente de rheumatismo tinha apenas 2 annos e meio.

Para retirar dos doentes os elementos de estudo bacteriologico, usei sempre da mais rigorosa technica e asepcia.

Coloridas pela solução de Ziehl, todas as preparações deixaram ver, com pequena variante, abundantes nucleus do gonococcus de Weisser; ora achavam-se isolados, ora infiltravam os globulos de pús, sempre colorindo-se bem pela fuschina phenicada, a ponto de não deixar a menor duvida de sua abundante existencia.

Deixando de parte o interessante caso de rheumatismo blennorrhagico, convem lembrar o modo porque deu-se o contagio da blennorrhagia aos pequenos doentes. Tres haviam sido contagionados pelas proprias mães, que declararam achar-se, anteriormente a infecção de suas filhas, affectadas de abundante corrimento vaginal.

O caso que se refere ao rheumatismo tem sua origem da transmissão da blennorrhagia pela vehiculação do gonococcus por meio de uma bacia em que se lavava um tio materno da criança, affectado d'aquella molestia.

Os estudos microscopicos do sangue e do pus da abundante vulvo-vaginite d'este doente foram feitos repetidamente e com o maior zelo e vigor, em vista da importancia do caso, verificando sempre o gonococcus, que até consegui, como Criveli, cultivar em agar-agar peptonisado, e observar a forma adquirida pelo germen que proliferou no caldo. Esta forma era a mesma descripta por Peyer no seu Atlas de Microscopia Clinica.

Não tentei fazer inoculações em animaes porquanto sabe-se que a blennorrhagia só é transmissivel aos individuos da especie humana.

THE RACE FACTOR IN DISEASE AS ILLUSTRATED BY PNEUMONIA IN THE NEGRO.

By J. WELLINGTON BYERS, M. D., of Charlotte, N. C.

Modern etiological investigation and study has succeeded in ascertaining and defining the exact scope and influence of a number of the most important contributory conditions and exciting causes of the acute zymotic diseases, though there still remains much to be learned and interpreted in bearing upon disorders of this class. In respect to the agencies of class, climate, age, sex, occupation, and habitation we already possess considerable accurate and valuable data. As regards the influence of the factor of race and nationality upon the advent and type of morbid phenomena we know as yet very little that is exhaustive and trustworthy, and there remains much to be recognized and understood. Up to this time, so far as I am aware, no one has made any systematic effort to determine the specialty of disease as it occurs in the various races of the world. This is true in the light of the fact that a number of disorders are far more formidable and lead exceptionally often to fatal results in the yellow and darker races as compared to the white. From an examination made of the mortality rates of the negro population of the Southern States of this country I have found in a number of instances that they were double that of the associated whites. In those communities where the population is a mixed one, possessing the negro contingent, this assertion can be easily verified by anyone who takes the pains to examine. Such being true, we find ourselves confronted with the solution of a grave problem connected with the welfare of a large number of people.

Is it possible, aside from the contributory agencies of age, sex, class, climate, and environment in general, that we have a distinct and measurable factor of race, and that one people should possess and manifest special proclivities to and exemptions from disease causes? In other words, is the unusual tendencies toward scrofula, consumption, and allied disorders shown by the Saxon people the effect of circumstances of life or of inherent racial traits? Are the Semitic people prone toward cancerous disease and melancholia and exempt from contagious disease to a degree evidencing almost a charmed life because of their habits of life, or by virtue of anatomical and corresponding physiological peculiarities of structure? In the light of data now available it is reasonable to conclude that the latter is true to some degree. Indeed it is fair to assume that all people of different stocks will differ as much physiologically as they do morphologically, yet it is very difficult in the absence of definite knowledge to demonstrate or affirm, in any particular case, how much of a supposed racial trait is due to original and inherent peculiarities and how much to the effect of circumstances of environment. There are considerable facts, however, to show, for some diseases at least, that variations are not due to fluctuations in environment. On the other hand, experiences show how potent the external conditions of existence are in determining disease. Every organism tends to

become adapted or acclimated to its conditions of life, and all the structures of a species, accustomed through countless generations to the climate, soil, food, and various other influences of a given locality, are molded into harmonious coöperation favorable to life in that locality, the result being that in the development of each young individual the tendencies conspire to produce a fit organism. It is otherwise when the species is removed to a habitat of different character. The Esquimaux will perish from consumption if removed to Copenhagen, although a few centuries ago he was of the same Scandinavian stock. In the transition the organs, partially out of harmony with the demands of the new life, become partially out of harmony with one another, and in this way the perturbed relations of the organs interfere with their original equilibrium and prepare the way for disease.

There are a number of diseases which illustrate the tyranny of organization and the influence of race, but the limits of this paper preclude their mention here. In the substantiation of the factor of race as an element in disease etiology I have selected a few statistics of the disease pneumonia. In investigating all of the available data pertaining to this disorder I have been impressed with the unusual susceptibility of the negro. In my practice among them in the South I have had occasion to notice the rapidity with which they pass into the apathetic and fatal condition. Many years since Austin Flint, in his work on practice, observed that "in sections of the Southern States pneumonia prevails at times sufficiently to be considered as endemic, and, affecting the negro population, often proves the scourge of the sugar and cotton planter." Reynolds's system says: "In certain sections, as in Sierra Leone, the Cape, and Mauritius, the negro race appears to suffer more than the whites." Hirsch, in his work on the geographical distribution of disease, says: "The same holds true in regard to the South American countries," and adds that "while immigrants from northern latitudes to subtropical or equatorial regions enjoy comparative exemption from inflammation of the lungs, the natives of the tropics, and most of all negroes, are subject to the malady in quite a peculiar degree, not merely when they go to colder climates, but also in their natural habitat." Pruner says: "The negro is excessively liable to pneumonia in Cayenne, and the malignancy of the disease is famous for its appalling fatality." Observers all admit of the fatality of this disease in Soudan, Zanzibar, and the west coast of Africa generally.

From the figures and citations it appears that the climate and situation has but little *per se* to do with the causation and results of this disease in the negro, and it matters little at what place or in what circumstances of climate or conditions of life he may be placed, he manifests a distinct and peculiar proclivity for this disease. Indeed, environments so potent in modifying and controlling the pathogenicity of many disorders of this class have but little effect in this one. Dr. Billings has noticed this, and in summing up his conclusions in regard to pneumonia as presented in the data of the tenth United States census, says, "The evidence furnished by the census does not favor the theory that this is a disease dependent upon climate or cold." The statistics of European countries also substantiate this, and we find pneumonia equally as prevalent and fatal in the southern section of Spain, Italy, France, and Greece as in Russia and Norway and Sweden. In all Europe the average death rate from this disease is the same as in the United States, being 15 for 1,000 population. In the States of Louisiana, Missouri, and Arkansas the mortality among the blacks reaches as high as 146 in each 1,000 deaths from all causes, the rate in the rural parts being as excessive as 152.8 and in the cities and in towns 111 for 1,000 deaths. The average rate of deaths among the whites in the United States is 108.88 and for the negro it is 142 for 1,000 deaths, being a difference of over 25 per cent. In pneumonia we know from experience that the factor of age is of itself sufficient to produce differences in the form or type of disease. In children we nearly always find the catarrhal or bronchial form, while in adults the lobar type is the rule. This holds true while the specific or germ factor remains the same in both. For an

explanation of this modification we must look to the coöperant conditions as found in differences in the structure of the lungs involved, and analogous conditions appear to hold good in regard to race. The foregoing figures point unmistakably to the conclusion that the colored race is more liable or susceptible to this disease. They are taken from a considerable portion of the territory of the earth, embracing almost every latitude, class, and condition.

As to what constitutes this special liability to the pathogenic agents of pneumonia and why it should prove so exceptionally fatal in this people science at this time does not furnish a satisfactory reply. The specific etiology and pathology has been very clearly determined, though wherein the particular defect of cell life or function or vital resistance exists is not understood, and I shall not attempt to speculate. In a general way we can conclude that there must be some defect of anatomical structure leading to corresponding defect of physiological competence in the tissues engaged in the struggle for existence between the cell and the germ of this disease. As to what this is and how it operates we do not know. My chief object in directing attention to this phase of etiology is to awaken interest in a much-neglected though vastly interesting and important field. As medicine becomes more scientific it must of necessity investigate all the facts concerned, and allot to each its importance in any given instance. In my contributions to Wood's Handbook and Keating's Cyclopædia I have dwelt at length upon certain phases of this subject, and have attempted to outline some of its bearings and indications.

SECTION XII.—OPHTHALMOLOGY.

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Dr. JULIAN J. CHISOLM, 114 W. Franklin street, Baltimore, Md.

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Dr. JOAQUIN DE SALTERAIN, (Canelones 8) Montevideo, Uruguay.
Dr. MIGUEL CASTILLA, Merida, Venezuela.

PROCEEDINGS.

The section meeting was at the Arlington Hotel, September 5, 1893, and was called to order by the executive president of the section, Julian J. Chisolm, M. D., LL. D., of Baltimore. Md., the English-speaking secretary, Dr. George M. Gould, of Philadelphia, being present as secretary. At this time or during the subsequent sessions the following members of the section were registered:

Dr. J. J. Chisolm, Baltimore, Md.
Dr. Geo. M. Gould, Philadelphia, Pa.
Dr. A. Alt, St. Louis, Mo.
Dr. A. R. Baker, Cleveland, Ohio.
Dr. Clarence R. Dufour, Washington, D.C.
Dr. T. J. Tyner, Austin, Tex.
Dr. A. D. Mansfield, Baltimore, Md.
Dr. Columbus Drew, Jacksonville, Fla.
Dr. Walter B. Johnson, Paterson, N. J.
Dr. G. C. Savage, Nashville, Tenn.
Dr. Flavel B. Tiffany, Kansas City, Mo.
Dr. Amy S. Barton, Philadelphia, Pa.
Dr. S. F. McFarland, Binghamton, N. Y.
Dr. Hobard I. Dye, Washington, D. C.
Dr. William H. Fox, Washington, D. C.
Dr. A. C. Corr, Carlinville, Ill.
Dr. P. Lagleyze, Buenos Aires, South America.
Dr. Lopez, Havana, Cuba.
Dr. J. W. C. Love, City of Mexico.
Dr. Alvin A. Hubbell, Buffalo, N. Y.
Dr. E. Oliver Belt, Washington, D. C.
Dr. Francis Valk, New York City.
Dr. Richard H. Satterlee, Easton, Pa.
Dr. Anton Coe, Washington, D. C.
Dr. S. B. Muncaster, Washington, D. C.
Dr. F. W. Frankhauser, Reading, Pa.
Dr. Henry Redmond, Philadelphia, Pa.
Dr. E. B. Mathiot, Pittsburg, Pa.
Dr. J. Fred. Herbert, Philadelphia, Pa.
Dr. Swan M. Burnett, Washington, D. C.
Dr. T. R. Wolfe, Glasgow, Scotland.
Dr. Arthur G. Hobbs, Atlanta, Ga.
Dr. G. Edgar Dean, Scranton, Pa.
Dr. S. D. Risley, Philadelphia, Pa.
Dr. Louis F. Love, Philadelphia, Pa.
Dr. Franklin Mills, Chicago, Ill.
Dr. E. Jackson, Philadelphia, Pa.
Dr. B. W. James, Philadelphia, Pa.
Dr. S. S. Koser, Williamsport, Pa.
Dr. H. Snellen, Jr., Utrecht, Holland.
Dr. C. W. Kollock, Charleston, S. C.
Dr. D. R. Murdoch, Baltimore, Md.
Dr. Richard H. Lewis, Raleigh, N. C.
Dr. Peter D. Keyser, Philadelphia, Pa.
Dr. C. L. Frey, Scranton, Pa.
Dr. G. W. Allyn, Pittsburg, Pa.
Dr. Casey A. Wood, Chicago, Ill.
Dr. Howard F. Hansell, Philadelphia, Pa.
Dr. E. Burke Haywood, Raleigh, N. C.
Dr. Louis J. Lautenbach, Philadelphia, Pa.
Dr. S. Lewis Ziegler, Philadelphia, Pa.
Dr. M. T. Osio, Madrid.
Dr. Hiram Woods, Baltimore, Md.
Dr. George T. Stevens, New York.
Dr. R. L. Lewis, Raleigh, N. C.
Dr. E. M. Nolan, Jacksonville, Fla.
Dr. John Dunn, Richmond, Va.
Dr. Franklin Miles, Chicago, Ill.
Dr. E. G. Kimball, New York.
Dr. William A. Frazier, Staunton, Va.
Dr. C. R. Holmes, Cincinnati, Ohio.
Dr. F. B. Loring, Washington, D. C.
Dr. F. M. Chisolm, Baltimore, Md.
Dr. C. H. McConache, Baltimore, Md.

ADDRESS BY THE PRESIDENT OF THE SECTION, JULIAN J. CHISOLM, M. D., LL. D.

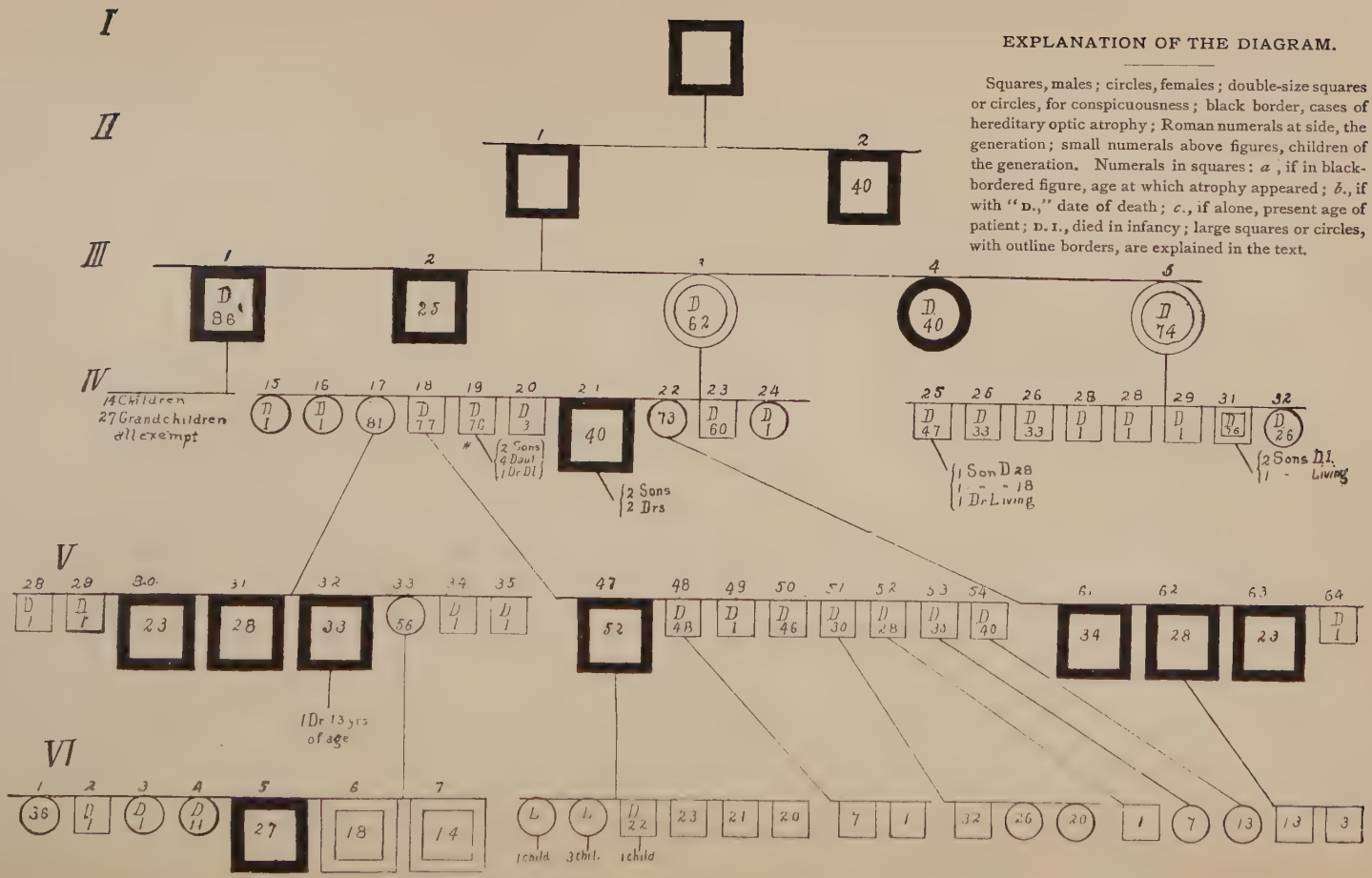
Honored Colleagues: It gives me much pleasure to have you participate in the Columbian festivities, of which the Pan-American Medical Congress is a part. Congresses on various subjects pertaining to the sciences and the arts have been held at Chicago in commemoration of the discovery of America. When the doctors of this continent assemble in Washington it is only an extension of the general features of

this memorable anniversary. As surgeons we will assist, in our own way, to further the desire to make the year 1893 one to be long remembered in the history of our nation. Within the last few months there have been several gatherings of medical men: and yet we have our special mission. With medical advancement for our stimulating theme, we are anxious to help in the development of that great object, "The preservation of health," which is so closely allied to the creative power.

Every day the human race is becoming more aware that good eyesight is a most precious gift, and it is beginning to learn how to guard that gift zealously. Common school physiology has taught men that the healthy functioning of any organ of the body is not to know of its existence except through the comforts which it gives us. As soon as we are aware of its presence there is something wrong which requires correction. We, who are the special custodians of human eyesight, have come together to collate individual experiences and to put on record what we are doing in the way of maintaining the perfect working of this wonderful visual organ. In arranging the programme of work for the section I have deviated from the ordinary course of discussing promiscuous papers only, and have assigned two topics especially for our consideration, "Refractive errors, and muscle irregularities: How to detect and correct them." These two eye troubles comprise the heavy daily work of the ophthalmic surgeon. From the frequent appeals for relief the correction of these interferences with comfortable vision seem to be even more important to the masses of humanity than the great operations, when we restore sight to the blind by the most delicate of surgical manipulations.

I presume that my personal experience simply reflects the daily experience of each one of us, which is that refractive and muscle irregularities are as frequently met with as all the other eye affections put together. To have acute vision and not to be able to use the eyes with comfort is very worrying to thousands of people. To make painful eyes work smoothly and to remove head discomforts of long standing as if by magic, through the instrumentality of carefully adjusted spectacles, is a wonderful art, which is enthusiastically recognized by former sufferers. To effect this with certainty and with expedition is most desirable knowledge, and we are all seeking it. At the present time perfect relief is not always attainable. The majority of troublesome eyes adapt themselves promptly to the glasses which we adjust, and can be used painlessly when the proper spectacles are worn. But sometimes we meet with rebellious eyes, which our utmost care can not quiet; and yet we feel that these should also be brought under control. We try many ways to accomplish this desired object. Experience has taught each of us a method which we individually think is more convenient or more expeditious than the course pursued by others to secure the same end. Time is valuable to both surgeon and patient. All desire quickly to secure surely the best results. Our object is to study these individual methods. In refraction cases a very important question is when to use mydriatics, and to determine which of this class of remedies is the most reliable and least annoying. In our eager pursuit after the cause of the eye disturbance we must not forget that the patient also has some rights. To blur vision for a fortnight by atropine, if the same results can be secured by homatropine, which disturbs sight for only a few hours, is an abuse of professional power against a confiding patient, to whom every hour for labor may be needful to secure bread for the daily wants. We also desire to know to what extent we can be surely aided by apparatus, other than the trial case, to detect the kind and the degree of refractive error.

For many years we have been studying with diligence the faults in the eyeball itself, and how to help the ciliary muscle to accomplish its important work, often to the neglect of the much larger, more numerous extra ocular muscles, with equally important functions, to insure comfortable vision. We are only now waking up to the fact, too long overlooked, that the irregular action of these outer muscles fill a very conspicuous roll in causing eye discomforts. The want of equilibrium in their action must be recognized. The temporary or permanent use of prisms to strengthen



EXPLANATION OF THE DIAGRAM.

Squares, males; circles, females; double-size squares or circles, for conspicuousness; black border, cases of hereditary optic atrophy; Roman numerals at side, the generation; small numerals above figures, children of the generation. Numerals in squares: *a*, if in black-bordered figure, age at which atrophy appeared; *b.*, if with "D.," date of death; *c.*, if alone, present age of patient; D. I., died in infancy; large squares or circles, with outline borders, are explained in the text.

DIAGRAM OF HEREDITARY OPTIC ATROPHY.

weak muscles, or the cutting of the over strong ones, are important problems for serious consideration. Complete or partial tenotomies is one of the questions of the hour.

To each of these subjects, which are now the leading ones in ophthalmic circles, we propose devoting an entire day, with the hope that so much knowledge will be elicited by the discussion as to enable us to define clearly rules for professional guidance.

PAPERS READ BEFORE THE SECTION.

HOMEOCHRONOUS* HEREDITARY OPTIC-NERVE ATROPHY, EXTENDING THROUGH SIX GENERATIONS.

By GEORGE M. GOULD, A. M., M. D., of Philadelphia, Pa.,
Ophthalmologist to the Philadelphia Hospital.,

The cases I herewith report are in several aspects unique, and in their suggestions and inferences are of most abundant interest. The diagram annexed shows fourteen or more instances of hereditary optic atrophy, scattered through six generations. The details will be made clear under the general aspects considered as follows:

PATHOGENY AND PATHOLOGY.

The earliest ancestor in whom, so far as ascertainable, the affliction appeared was a sea captain. All that I can learn about him is that he became blind and deaf somewhat late in life. His two sons became blind "from the same type of disease as that which has since appeared in the later generations." The hereditary nature of the affection is certain from the first generation downward. The primary cause, so far as I can see, is involved in complete mystery. The disease seems to be typical white atrophy of the optic nerve. In my patient the failure of vision was first noticed in March, 1892, and in nine months progressed to barely counting fingers. I have been able to get reports from hospitals, and other oculists who have examined other members of the family affected, and they all agree in the diagnosis.†

Macular vision is not so good in my patient as vision with a more peripheral portion of the retina. In a number of the cases the blindness is not absolute, but the patients have some slight vision that is retained through life.

The influence of sex in transmitting the malady is most marked and peculiar. In the entire series of histories there is not a pure or idiopathic instance of the appearance of the disease in a woman. In the third generation No. 3 had "weak eyes" and persistent "watering" of the eyes, but she was not blind. Her sister, No. 4, became blind before her death (at 40), but she was "horned in the temple by a cow and one eye thus destroyed," blindness following in the other eye a few months later. The remaining sister, No. 5, became blind late in life, from what cause I am unable to say. As none of her children were affected, I am inclined to think the cause must have been cataract and not optic atrophy.

But the most interesting phase of this subject consists in the remarkable fact that after the second generation no man transmits the affection to his descendants, and it is always transmitted by women who are unaffected. Passing the line through a male, even though he himself is blind with the disease, at once stops the appearance

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*Ὅμοιος, similar; χρόνος, time. Applied to a hereditary trait or disease, appearing at a similar age or time of life in a line of descendants.

†I am greatly indebted to Rev. T. M. Jackson, of Norristown, Pa., for his patient and scientific labor in gathering the details of the cases reported

of the disease. In this respect a similar law obtains in the hereditary transmission of hemophilia, which is often or largely through unaffected females. The same peculiarity has also been observed in idiopathic muscular atrophy, and I think cases of color-blindness have also been reported.

It is most noteworthy that in one group of my cases the inheritance is consecutively transmitted through two unaffected females, and in another group it is passed through three women.

There is one seeming or partial exception to the last law. In the fourth generation one man has a blind son, No. 4, who still lives at the age of 52. "While chipping something, a small piece flew in the eye; the injury was slight, but blindness resulted. The other eye is now partially blind and failing." This incident, together with others, and especially the histories of the three sisters in the third generation, show that normal vision or ocular health in the family was always on a precarious equilibrium, and when optic atrophy did not arise idiopathically only a slight accident or exciting circumstance was needed to bring on a train of evil results.

INGRAVESCENCE OF THE AFFECTION IN LATER GENERATIONS.

According to *apriori* expectation, and also according to other histories and hereditary laws, we should expect the disease to decrease in virulence with each intermixture of new blood, or with each marriage. But in the diagram we note that in the fourth generation there is but one example, while in the fifth there are six or seven. In the fifth generation there is but one woman who became a mother, and of her children I shall speak by and by. It seems clear that if there had been more mothers in the fifth generation there would have been a sad increase of blind men in the sixth generation. Did nature with subtle wisdom prevent this? It would also seem that the age at which the affliction appears is earlier with later generations.

IF NOT OPTIC ATROPHY, DEATH.

The proportion of early deaths has struck my attention. This begins to become manifest in the fourth generation. In the children of III-3 there are four deaths in infancy, in those of III-5 there are three, besides three or four deaths in early adult life—at about the age the optic atrophy appears in others. In the fifth generation all the males that live in one family are afflicted with blindness in early adult life, and the four other males born die in infancy. This virulence is to be connected with the fact that the line comes through a female. In the children of the second family the line passes through a male, and while the law is greatly modified, its power is shown by one death in infancy, and others at 28, 30, 35, 40, 46, and 48, with one case of blindness secondarily induced. In another family of this generation two males died in infancy, only one son surviving; in another, two sons died in early manhood, etc. The fathers of these transmit the line; but in the last case to be cited a mother is the medium, and of her four sons one dies in infancy and the other three are struck with blindness at 23, 28, and 34, respectively.

In the sixth generation, the only children who have a mother in this ancestral line are thus endowed: Three die in infancy; one, a girl, has a "weak mind;" one has optic atrophy at 27, and two younger brothers have chronically abnormal eye-grounds and optic-nerve heads.

Finally, it is suggestive to see that this law of extinction is probably now complete, or about to end. If my reading of the facts is correct, i. e., if only the female transmits the tragic inheritance, and only to males, there will, so far as I can learn, be no further cases, except possibly in the brothers of my patient VI-5. Every female of the line is now dead or childless. After discovering this law I was greatly anxious to see the brothers of my patient. With much difficulty I at last succeeded. My little scientific pleasure was immeasurably overbalanced by the sad ophthalmoscopic findings. In both there was a retina congested, stippled, and with chronic

degenerative changes taking place, an optic nerve unhealthy, without clear outlines, and hyperæmic—altogether a morbid fundus—though the young men have so far had no visual trouble. I shall watch the approach of the ominous age with much interest.

There still remains to note the great predominance of males in the later generations, a factor that tends to bring the vicious inheritance to a sharp ending. But the same purpose is outworked, and more manifestly by the rapid decrease of prolific females whose ancestral line descends through women unbroken by a male of the line. In the third generation, when the vicious tendency becomes manifest, there are two child-bearing females, a percentage to all children born of 66⅔. In the fourth generation the percentage is less than three, and in the sixth generation it is brought to zero. There is now no existing female, except one mentally weak and childless, who has had uninterrupted female ancestors of the line back to the second generation.

HOMEOCHRONICITY.

Habershorn (Transac. Oph. Soc. Unit. King., 1888) gives a complete review of the literature of hereditary optic atrophy up to the time he wrote. In the great majority of the cases he reviews, the ages at which the onset of the disease occurred fall between 15 and 19. In both sexes the cases more or less roughly group themselves about the period of purberty, and that approximating 40. The cases I report decidedly neutralize this law, if such it may be termed, and throw the subject back into the mystery into which it seemed emerging. In the first three or four generations there was some approximation toward grouping about the age of 40, but in the last two generations the onset of the disease more clearly and decidedly clusters about the ages of full adult vigor, i. e., from 23 to 34.

In discussing the paper of Dr. Gould, Dr. Burnett, of Washington, D. C., said he had seen one instance in which the female was affected. The patient first examined was a boy of eight years, who had been nearly blind (V. $\frac{3}{60}$) since early childhood. His mother, who was present, was examined and a similar condition of the optic nerve was found. The family history, so far as it could be ascertained, extended three generations back, but had always been transmitted through the females.

GLAUCOMA POR TRAUMATISMO OPERATORIO.

Por el Dr. E. LOPEZ, Habana, Cuba.

La discisión de la catarata secundaria se practica hoy día con frecuencia, y algunos cirujanos, con objeto de obtener el maximum de agudeza visual, desgarran sistemáticamente la cápsula por tenue que sea la opacidad.

Esta práctica obedece á la sencillez de la operacion. Basta, en efecto, introducir una aguja apropiada ó un instrumento cualquiera puntiagudo á través de la córnea y desgarrar la opacidad, seccionándola en cruz, en T, en ángulo, ó del modo que el operador crea más á propósito para alejarla del centro de la pupila.

Como no siempre se logra obtener este resultado, hay que repetir la operación dos ó más veces, ó bien recurrir al procedimiento de deslaceración mediante dos agujas que después de encajadas en la opacidad, una sirve de apoyo, mientras que la otra la desvia obrando como una palanca, y vice versa.

Como se ve, nada es más fácil que practicar esta operación, cuya herida de la córnea puede estar cicatrizada al siguiente día, y el enfermo haber mejorado su vista.

Pero no siempre se tiene tan buena fortuna, y en prueba de ello me propongo demostrar que la discisión de la catarata secundaria va casi siempre seguida de glaucoma. Solo excepcionalmente deja de ser apreciable esta complicación.

Todas las veces que he desgarrado la catarata secundaria, ya sea con una ó dos agujas, un cuchillete de Graefe, de Knapp, ó cualquiera otra forma que el instrumento tenga, que la desgarradura se haya hecho con las formas más variadas,

siempre se ha producido una reacción glaucomatosa más ó menos intensa. En el adjunto cuadro presento un resúmen de 26 discisiones, que contiene el modo de operar, las complicaciones sufridas, y los resultados obtenidos.

El enfermo de la observación 24 toleró una segunda discisión con dos agujas, sin la menor reacción, puesto que el día después de la operación, apenas hubo una ligera inyección conjuntival. En la primera discisión, que se le hizo también por el mismo procedimiento, tampoco hubo dolor ni reacción marcada. En las observaciones 2 y 4 acusaron los enfermos un poco de dolor, y hubo inyección conjuntival periquerática, trastornos que se disiparon rápidamente.

En la mayor parte de los casos se declaró de las 4 á 10 horas después de la operación un ataque de glaucoma de mediana intensidad, con T > n. (aunque este síntoma no lo busqué en algunos casos cuando aún no pensaba en esta complicacion), viva inyeccion de la conjuntiva al rededor de la córnea ó en toda su extension, dolor más ó menos agudo, limitado al ojo ó extendiéndose á toda la rama oftalmica, dilatacion pupilar, lágrimas, enturbiamiento de los líquidos intraoculares, disminución de la vista, y dificultad para mover el ojo.

Pero estos fenómenos, aunque alarmantes al principio, se disipan en el transcurso de algunos días.

En otros casos el glaucoma ha sido agudo, y tan característico que me ha decidido á ser sobrio y muy prudente en la práctica de esta operacion. Referiré á grandes rasgos la observación 16, en que un glaucoma fulminante produjo rápidamente la atrofia de la pupila en medio de agudísimos dolores.

A un individuo blanco, de 57 años, artrítico, muy grueso y de cuello corto, le extraje la catarata de un ojo sin accidentes, y curó pronto dejando una secundaria bastante tenue. A los 32 días la operé con un cuchillete de Knapp, desgarrándola en dos direcciones y obteniendo inmediatamente una hermosa pupila negra, á traves de la cual vió claramente el enfermo. Esta operación se hizo con todo rigor antiséptico, y se usaron instrumentos nuevos. Después de terminada se aplicó un vendaje protector.

A las 24 horas de la operación se declaró dolor fuerte en el ojo que se irradiaba á toda la rama oftálmica, con sensación de tension, con edema de los párpados y de la conjuntiva, con oftalmoplegia, exoftalmos, pupila dilatada, abolicion de la vista y gran dureza del ojo. A las 40 horas tuvo escalofríos y vómitos repetidos y agravación de los síntomas antes indicados. El dolor se mostraba por punzadas intermitentes intensísimas.

El quinto día el quemosis conjuntival era aún mayor, y el enfermo en el colmo de la desesperación rehusó más obstinadamente que al principio la iridectomia que le propuse como único remedio que podía curarle con éxito.

Al cabo de una semana remiten todos los síntomas, pero persisten T > n, anestesia de la córnea, disminución de la vista y enturbiamiento del humor vítreo.

Desde esta época el glaucoma ha tenido accesos con intervalos variables. Al fin la cesación de los fenomenos agudos se ha debido á la distensión de la cicatriz de la primera operación, que á los 150 días parecia no existir en ella más que una ectasia formada por el iris retenido por algunas fibras corneo-esclerales. La pupila estaba en esa fecha muy dilatada, los humores intraoculares algo turbios y T > n, aunque menos duro que en el principio. La opacidad había quedado definitivamente rechazada al tercio inferior de la pupila. A traves de esta se veía la pupila atrofiada y totalmente excavada. El campo visual estaba muy reducido en todas direcciones (aunque con la particularidad de hallarse casi abolido del lado externo), y la vista había quedado reducida á la percepción de la luz.

Es indudable que este ha sido un caso típico de glaucoma agudo y que no tuvo otra causa más que el traumatismo operatorio.

Entre los ojos de tendencia glaucomatosa y otros refractarios á esta complicación hay una gradación que depende de la intensidad de la reaccion uveal, y de la anchura de las vías excretorias.

Pero, ¿cómo puede la discisión producir el glacoma cuando en tantos otros traumatismos operatorios no se le vé aparecer? Veamos primero lo que es el glaucoma. Lo considero como una consecuencia de la hipersecreción de la glándula uveal, si afecta la marcha aguda; y en la crónica lo creo debido á la deficiencia de las vías excretorias, haya ó no aumento en la producción de los líquidos intraoculares.

Partiendo de esté principio me explico la génesis del glaucoma después de la discisión del modo siguiente: Al desgarrar la cápsula con cualquier instrumento que sea y con cualquiera forma que se dé al corte, se determinarán tracciones sobre la opacidad. Estas se trasmiten al ligamento suspensorio del cristalino, que por sí y mediante numerosas fibrillas zonulares adhiere á la glándula uveal.

Sufre, pues, esta glándula en el acto de la discisión una fuerte irritación que se traduce por hipersecreción brusca de humor acuoso, y desde ese momento se habrá originado un ataque de glaucoma agudo, con todo el cuadro de síntomas que desarrolla el aumento de la tensión intraocular. Esto, en efecto, es lo que pasa casi siempre que se practica la operación.

Si las vías excretorias son amplias no llegará á constituirse el estado glaucomatoso; si son normales aparecerá el ataque, pero al cabo de algunos días se restablecerá el equilibrio de la tensión, y el enfermo habrá dominado la crísis. Pero en individuos predispuestos al glaucoma, como en los artríticos, ateromatosos y otros en quienes no sabemos sospecharlo, pero que consideramos que tienen todos de común la insuficiencia de las vías de excreción, el ataque puede llegar á ser brutal, y la vista quedará perdida ó gravemente comprometida.

¿Puede evitarse la aparición del glaucoma en las operaciones de secundaria? Se logra ciertamente suprimiendo las tracciones de la glándula uveal.

Desde luego creo más conveniente desgarrar la opacidad con dos agujas, de las cuales una sirve de apoyo mientras la otra desgarra. De este modo se evitan al menos tracciones violentas. Sin embargo, en el cuadro que incluimos figuran casos de glaucoma siguiendo este procedimiento, de modo que no es grande la superioridad que ofrece sobre el empleo de una sola aguja.

Respecto al instrumento que ha de usarse me parece preferible un cuchillete puntiagudo á las agujas, aunque estoy seguro que ni con ellos se evita el traumatismo del epitelio de los procesos ciliares.

Soy parco en el uso de la discisión, sobre todo en los casos de secundarias espesas que necesitan fuertes tracciones para ser desgarradas.

La capsulotomia ó la irido-capsulotomia, en cambio, no ejerce la menor acción sobre los procesos ciliares. Así no debe extrañarse que á pesar de ser con ella mayor el traumatismo nunca dé lugar á un verdadero ataque de glaucoma.

Esta operación, aunque en extremo delicada por la destreza que necesita la introducción y corte de la pinza-tijera, tiene en cambio la gran ventaja de formar anchas pupilas y no tener complicaciones serias cuando se han empleado instrumentos asépticos.

Gracias á esta operación no tengo el disgusto de presenciar ataques de glaucoma. Cierto es que por lo común provoca una reacción moderada que se reconoce por la tumefacción del iris y por enturbiamiento del humor vítreo, y á veces inyección de los vasos subconjuntivales, pero con poco ó ningún dolor. La herida de la córnea cicatriza rápidamente, y el humor vítreo recobra su transparencia al cabo de algunos días.

Terminaremos proponiendo que se emplee contra las secundarias muy tenues la discisión con una ó dos agujas, prefiriendo esta última. Contra las secundarias espesas debe emplearse siempre la capsulotomia.

Núm.	Sexo y edad.	Operación.			Resultado.		Complicaciones.
		Diagnóstico.	Días después de la extracción.	Procedimiento.	Inmediato.	Definitivo.	
1.....	H. 55	[1]E.	15	2 agujas ..	[2]R.	R.	Glaucoma agudo desde las 4 horas, con dolor, inyección conjuntival, pupila dilatada, humor vítreo turbio. T > n.
2.....	H. 58	E.	60	2 agujas ..	R.	B.	Inyección vascular moderada, poco dolor.
3.....	H. 95	E.	78	2 agujas ..	R.	.....	Glaucoma agudo, intenso el primer día; desapareció lentamente.
4.....	V. 52	E.	180	2 agujas ..	R.	.....	Reacción moderada.
5.....	V. 49	E.	55	1 aguja ...	R.	[3]M	La opacidad se desprendió de parte de su inserción sin desgarrarse. Cicletis con dolor, inyección y tumefacción conjuntival y palpitación, enturbiamiento humor, acuoso y vítreo.
6.....	V. 42	[4]T.	44	1 aguja ...	[5]B.	R.	Reacción inflamatoria moderada; dolor.
7.....	H. 56	T.	17	1 aguja ...	B.	.....	Reacción moderada.
8.....	H. 70	E.	20	1 aguja ...	B.	B.	Glaucoma agudo, intenso durante 5 días, desapareció después de un mes.
9.....	V. 49	E.	[1]42	1 aguja ...	M.	M.	Reacción glaucomatosa moderada.
10.....	V. 49	E.	[2]41	1 aguja ...	M.	M.	Reacción glaucomatosa moderada. El resultado fué nulo por las abundantes masas corticales que había detrás de la cápsula.
11.....	H. 60	E.	360	1 aguja ...	B.	B.	Reacción glaucomatosa de mediana intensidad.
12.....	V. 58	E.	37	1 aguja ...	B.	R.	Ciclitis moderada.
13.....	H. 56	T.	[1]90	1 aguja ...	B.	B.	Reacción moderada; dolor muy fuerte la primera noche.
14.....	V. 42	E.	[1]130	1 cuch	B.	B.	Ciclitis moderada; poca reacción y escaso dolor.
15.....	V. 48	T.	26	1 cuch	B.	R.	Dolor, congestión, disminución de la vista, etc.
16.....	V. 54	T.	32	1 cuch	B	M.	Glaucoma sobreagudo.
17.....	V. 55	E.	27	1 aguja ...	B.	R.	Glaucoma de mediana intensidad, declarado á las 10 horas; duró 4 días.
18.....	V. 57	E.	20	1 aguja ...	B.	B.	Glaucoma moderado con dolor durante tres días.
19.....	V. 48	E.	12	1 cuch	B.	.....	Glaucoma moderado.
20.....	V. 65	E.	22	1 aguja ...	B.	B.	Glaucoma; dolor intenso de la primera rama por 9 días.
21.....	V. 54	T.	12	1 cuch	B.	R.	Ciclitis; cámara anterior profunda; dolor.
22.....	V. 54	T.	[1]10	1 cuch	B.	B.	Glaucoma de 6 días; ataque á las 10 horas.
23.....	V. 62	E.	8	2 agujas ..	B.	R.	Apenas hubo reacción; sin dolor.
24.....	V. 62	E.	[1]31	2 agujas ..	B.	B.	Indolencia.
25.....	V. 65	T.	30	2 agujas ..	B.	B.	Glaucoma moderado.
26.....	V. 65	T.	30	2 agujas ..	B.	B.	Glaucoma moderado.

[1] Espesa=E. [2] Regular=R. [3] Malo=M. [4] Ténue=T. [5] Bueno=B.

El exponente en la cuarta columna indica el número de secundarias practicadas en la misma persona.

THE ETIOLOGY AND EARLY MANAGEMENT OF GLAUCOMA.

By G. E. DEAN, M. D., of Scranton, Pa.

Although much attention has been given by authors to the subject of glaucoma, a great deal of the mysticism of the past has clung to it, causing most observers to class it with the inscrutable, while the few ventured to explain it by fine-spun theories. Believing that the theories of the causation of this important disease of the eye, which I learned from the text-books of a dozen or more years ago and which I heard taught in Vienna in 1887, must, from their very nature, be nothing better than fragmentary, I have been making some observations independent of theory, either dignified by age or newly preconceived. If the conclusions arrived at should, as I venture to hope, throw some light upon the etiology of the disease, give definite aim to the labors of the pathologist, and lead up to a more rational plan of prophylaxis or treatment than has prevailed in the past, I shall feel more than repaid for the effort expended in the researches.

My first observation was that the theory given in the excellent treatise of Soelberg Wells—mostly quoted from Graefe and which we may call the anterior inflammation theory—however attenuated, would not apply to all cases and was, therefore, untenable as a general theory. My next observation was that the theory taught us in the clinic of the celebrated Prof. Stellwag, by his first assistant, and which we shall call the choroiditis theory, while approaching a little nearer the bottom facts, did not at all cover the ground. It is evident that while degenerative choroiditis might be present in a good many cases, it was as likely to be a part of the pathological process as to maintain the higher relationship of cause to effect. Then I observed, year after year, that, with few exceptions, the cases of decided glaucoma, of threatened glaucoma, and of glaucomatous cupping without active symptoms, were in persons affected with astigmatism (frequently conjoined with hypermetropia); and it seemed to matter little how small the degree, 0.25 of a diopter being a not infrequent showing. Later I began to observe that the exceptional cases were myopes in whom a more or less similar condition of back pressure existed; or what is relatively the same, posterior weakness of the eyeball.

My next investigations led me into a study of the so-called "physiological cupping," and I found it such an elusive subject that I at last concluded that it was to a very considerable extent a delusive one. Perhaps the fairest explanation of it in all respects that can be given in brief, is to compare the whole subject with the inguinal canal in its healthy state, and its possibility of acquiring inguinal hernia. The conditions are analogous in the main, except as to size and the possible difference in time required to produce a similar effect from a similar cause. In both instances we have a point of weakness about certain vessels and subjected to more or less pressure from within. In each we may have this weakness exaggerated, it may be anywhere from a slight to an extensive degree, by a funnel-shaped depression or cupping outward which may be either congenital or produced. It is easy to understand that a tolerably constant undue pressure may gradually increase the depth of this cup or broaden it, and thereby gradually increase the element of weakness; or it may yield suddenly at the base and admit of a hernia de facto.

In the case of the optic disk, we have in perfect health, as it appears, an exceedingly slight depression about the vena centralis retinæ, and also some less rigid tissue there, apparently intended by nature to afford greater safety to the vein. Now in the highest state of nature this slight depression has an area of elevation around it which acts as an excellent bulwark of protection; but let it be subjected to a continued excess of pressure, slight though the accretion may be, as in the eye strain of defective refraction, and we may observe that the interfibrillar substance of the nerve is absorbed, leaving a broad, shallow cup (the atrophic cup of Fuchs), or, apparently independent of that, we may notice in other cases quite deep retrocession at the temporal side of the central vein without any very noticeable lowering of the general surface of the optic disk. In the former cases (atrophic) there is apt to be also atrophic change at the periphery of the disk, while in the latter cases this factor is at least not so noticeable. I am disposed to regard both these conditions as intermediate stages between a healthy condition of the nerve on the one hand and glaucoma on the other, more especially as I have seen inflammatory glaucoma in an eye with one of the deep narrow cups and a decided tendency toward glaucoma simplex in another, and because it appears that atrophy of this kind favors the developing of glaucomatous cupping. The optic nerve is placed very much like the cork in a wine bottle, i. e., as if forced in, so that outward and inward it is larger than in the middle; hence an atrophy which reduces its diameter tends to make it push out more readily, thus displacing the lamina cribrosa backward and admitting of the well-marked glaucomatous cupping.

Having given a brief résumé of the course of utterly unbiased reasoning which led up to the conclusion, though without introducing the cases, which would be interesting enough if time permitted, we shall unhesitatingly announce the prime underlying cause of the disease.

The keynote of glaucoma is eye strain and that usually from some defect of refraction. There is no need to make a great mystery out of glaucoma any longer. If it were possible to correct all the errors of refraction in a given community, correct them early, and keep them continually corrected by suitable and absolutely accurate glasses, then, in that community, glaucoma, apart from a few secondary and traumatic cases, would disappear. We speak advisedly in saying a few, for it is highly probable that these cases have largely been predisposed to by eye strain. We apprehend that the elucidation of this subject has been delayed somewhat through reverence for the opinions of the immortal Graefe. It is indeed a high tribute to his genius that his doctrine on the subject should have been accepted as the law governing research almost up to the present time. Graefe did wonderfully well, as well as it was possible to do in his day, but the age is progressive and the greatly improved refraction work, at least of some of the more careful men in this country, makes it possible to take a deeper and more comprehensive view into the etiology of this and certain other diseased conditions of the eye. Our object should not be to combat the theory of this or that individual, but to lay a foundation under them. Some of them at least, and perhaps most of them, contain good material and make such a presentable showing that they deserve to have something better than mist to stand upon. While we have already been laying considerable stress upon back pressure, and while we believe that in the average case the posterior portion of the eye earlier receives the impression which tends in the direction of glaucoma, we must never lose sight of the general truth that eye strain, the cause, is bipolar in its action; hence we must comprehend the effects produced both posteriorly and anteriorly and must not be surprised nor disconcerted by the variations in type met with in studying the disease. It is but natural that when a force acts in more directions than one, the manifestations produced may vary in character. Of course, in speaking of posterior strain, we are referring to that which takes place in and about the optic disk; and of anterior strain, referring to that which occurs in and about the cilliary region, including a tolerably large and important area. We further must not ignore the fact that there is lateral pressure as well, and that the venæ vorticosæ are important elements in the circulation of the eye. And perhaps there has not enough stress been laid upon the ease with which the retrochoroidal lymph space may become affected.

Concerning the effects of anterior pressure, it is not necessary to say much here, for the reason that it is so well described in the text books. Most of them doubtless attribute undue importance to disturbances in Schlemm's canal, as etiological factors; they are important enough to be sure, but it should be borne in mind that there are other and larger lymph channels in the eye. A close observer may notice that in a great many cases interference with filtration in that direction is the final act of a rather long ocular tragedy.

A strong argument that the early pressure effects are not so much forward as backward, is that so little scleral congestion is observable in the inflammatory cases compared to what is seen in iritis, cyclitis, etc. No wonder the scientist looked in vain for the cause during the attack, when the cause has been acting more or less quietly for years until the attack obscured it, and rendered critical study impossible. It should be remembered that in thousands of non-glaucomatous cases the same cause (eye strain) is acting, but finds enough resistance to prevent a glaucomatous effect from being produced. The optic nerve often withstands the strain so long and with so little local deleterious effect that we can but marvel at its power of endurance; and even when some retrocession has occurred, oftentimes no startling symptoms arise until the lamina cribrosa has been forced back to such an extent that the pressure in part is applied in a lateral direction almost directly upon the nerve sheath, upon the lymph channel surrounding it, and only less directly upon the posterior cilliary circulation. Likewise forward pressure in the ciliary region (i. e. practically in the opposite pole) is endured fairly well until it causes an impingement upon the

absorbent angle of the anterior chamber. But it will be observed that these are only climaxes in a process long since begun. It is highly probable also that in a considerable percentage of cases, strain at one pole is endured until too much strain is applied at the opposite pole; then the patient, suffering eye succumbs to overwhelming forces. In another of the diseases to which flesh is heir, viz, peritonitis, we have what may answer as an example in some respects of what is meant. So long as a peritonitis (nonpurulent) remains localized, it may seem comparatively insignificant, but let it assume a general form and all will admit its gravity.

Space will not here admit of going exhaustively into the subject of eye strain, but a few points may be briefly touched upon. We shall premise by saying that the term has too often been restricted in many minds, almost entirely to the apparatus of accommodation, rather ignoring the important part played by the recti muscles. It is true that, apart from myopic eyes, a large percentage of the strain comes from near work, and hence glaucoma as a fully developed disease is largely confined to persons of more or less mature years, when the eyes find some added resistance to the efforts of accommodation. It accounts also for its relatively greater frequency in hypermetropes. We should not be surprised to find, if sufficient statistics were available, that the average onset was a little earlier in hypermetropes than in some other classes of cases, just as we notice in them the relatively earlier necessity of wearing glasses for reading. A very possible reason why myopic eyes are less frequently glaucomatous arises from the fact that many of them do not find much difficulty of accommodation. Another factor is found in the general weakness of the posterior wall of the globe, making the excess of pressure relatively less felt at the disk than in hypermetropic cases.

Understanding that astigmatism is one of the greatest causes of eye strain, we must consider that the ideal eye for the production of glaucoma would be one with hypermetropic astigmatism. It is known to be rather frequent in such eyes, and doubtless a great many glaucomatous eyes classed simply as hypermetropic really had a slight astigmatism which was undiscovered. Statistics show that very few emmetropic eyes have been affected with glaucoma, so few indeed that it is exceedingly probable that they were cases of mistaken diagnosis.

If space permitted, we would refer to general conditions of the circulation and the system at large; to tonic spasm of the ciliary muscle, intra-nasal pressure, etc., as possible etiological factors. For the reason indicated it is impossible here to give a detailed explanation of our views regarding the mechanism of eye strain.

If the pathologist will take his cue from the clinical facts that eye strain is the general underlying cause of glaucoma, and further, that the earlier effects, so far as tending towards glaucoma are concerned, may be exerted backward quite as frequently as forward—perhaps far more frequently—he will soon find that the study of this disease does not lead him into such a mystical field as it has been pronounced by most of our authors. If then he will turn his attention to the admirable schematic cut in Fuch's Textbook of Ophthalmology, page 251, showing the lymph passages of the eye, and, observing how extensive they are, decide to make a general study of them in connection with glaucoma, he may find a rich field for investigation and produce some decidedly definite results.

EARLY MANAGEMENT OF GLAUCOMA.

It has been thought best to refer to the plan of treatment provisionally adopted as the "early management of glaucoma," for the reason that it applies primarily to those cases of glaucoma and threatened glaucoma which early come under the observation of the oculist; and it would be manifestly unfair to apply it only to a few neglected and desperate cases found in metropolitan hospital practice, and then reject it as unworthy. Of course, in this disease even more than most others, prevention is better than cure. The chief measure of prophylaxis is the early use of accurate glasses; but medication is also useful in that direction. The medica-

tion must, however, be followed up by glasses and no pains must be spared to make them exact. Of therapeutic measures perhaps the best we have as yet found are acetanilid internally, pilocarpine solution instilled into the eye, and the hot solution of boracic acid applied externally. The acetanilid has mostly been given in 8-grain doses, three or more times a day to the average adult, and 4-grain doses to specially susceptible females. Its action should be watched so that it shall not cause too great depression; and if the temperature is found subnormal, the dose should be lessened. My reasons for preferring pilocarpine to eserine are twofold; first, that while it may not be so strong a myotic, it seems to have a better effect in reducing ciliary congestion; secondly, it allays pain instead of causing it, as eserine does. We know of no reason why the strength of the solution should not be increased in critical cases; but 4 grains to the ounce is as strong as we have used. Whether the salicyllate of sodium does good of itself, we can not say positively, but at any rate it preserves the solution, and we have sometimes fancied that the pilocarpine solution was more efficacious when combined with it. So we invariably use it at the rate of 10 grains to the fluid ounce. Very possibly it may be found that hypodermic injections of pilocarpine (one-sixth grain) may be of service, but I have thus far never used them in this connection, preferring to rely upon acetanilid as internal treatment. Unless the patient was kept in a recumbent position and the circulation and temperature noted it would not be safe to make use of both these depressing agents at once. Perhaps we may find cases wherein this, as in so many other diseases, the recumbent position is highly advisable; but oftentimes the pain is of such a character as to make the patient restless instead of causing him to seek repose. For the hot external applications the patient was allowed to make an extemporaneous solution of boracic acid, but the mode of applying was as specific as possible. The applications were made with soft cloth dipped frequently (once a minute), kept at about the highest comfortable temperature, and continued twenty minutes each time. The frequency of repeating them varied with the case, from once a day to every three hours, or oftener. We had hoped to obtain favorable results from the use of gelsemium, but, at least in the dose employed, it did not yield as favorable results as acetanilid.

The early employment of temporary glasses is a measure not to be neglected in certain cases, for in these irritable eyes a sensible man will not attempt a great amount of subjective testing for glasses; and we doubt if many cases retain the same refraction when the acute and the subacute symptoms have passed that existed during those stages.

Regarding iridectomy in this disease, we are confident that it is an operation which will fall more and more into disuse. It was an empirical operation at best, and though it served a very useful purpose in its day it has comparatively little place in attending to the better-cared-for eyes of the present. While it may still remain a desirable procedure for certain urgent and neglected cases, it does not always produce satisfactory results, and should by no means be lightly adopted as routine practice.

DISCUSSION.

Dr. McFarlane. I am glad to know that some one has had such universal good fortune following operations for glaucoma. It has not been my fortune, nor the fortune of those with whom I have been most familiar, except in acute or subacute forms of the disease. I would refer to the report of a group of cases by Dr. C. S. Bull, of New York, in which the results were far from satisfactory. I think medication valuable as well as iridectomy, which can not be discarded.

Dr. Tiffany. In my first years of practice in Kansas City I had frequent cases of acute glaucoma; of later years they have been less frequent. I attribute this to the fact that the cause has been largely removed by the universal correction of low

forms of ametropia, as of hyperopia, of astigmatism, and of hyperopic astigmatism in particular.

Dr. REDMOND. I speak more through observation here and abroad, as these cases are not by any means common, yet in my experience I have found that surgical interference is almost always necessary. Cases in which I have seen iridectomy fail have been generally attributed to corneal vision instead of scleral.

Dr. ALT. Dr. Dean claims that eye strain is the cause of glaucoma. If it was the cause a great many more people would have glaucoma. There must be something else behind the eye strain, which even this paper on the etiology of glaucoma does not clear up, and for which no theory has yet fully accounted.

Dr. BAKER. The last case but one which I operated upon for glaucoma was in an old lady 74 years of age. If glaucoma is due to eye strain, as stated by the essayist, how would you explain it in such a case as this?

Dr. SAVAGE. Yes. In the old there is no ciliary strain; but strain of the recti or obliques can exist at 120, or any age. Such strain begins in infancy and ends only with death, unless relieved by treatment.

Dr. S. S. HOSER. I am loath to believe that these cases come to us sufficiently early to make out with exactness these low grades of refraction. Certainly those who come to me are. And as to therapeutic management, I have not seen much success therefrom. On the contrary, rather let us operate early, while it is yet possible to do an iridectomy neatly, and not wait until the iris is so degenerated that an equally clean operation can not be done.

Dr. TYNER. I have my doubts as to the existence of chronic glaucoma and to eye strain. They rarely ever come to us in time for correction. Most of my cases have been in persons who were poor and did not use their accommodation. That a real and timely-made iridectomy is mostly successful I am sure.

Dr. J. J. CHISOLM. While an iridectomy is the only reliable treatment for glaucoma, especially the acute forms, I have sometimes derived such excellent results from eserine as to do away in some instances with the need of the operation. Only to-day I saw a case in a gentleman whom I had first seen in August, fifteen days since. He was 62 years of age and had been suffering intensely for ten days with inflammatory glaucoma in the left eye The eye was much injected, pupil enlarged, anterior chamber obliterated, tension marked, and sight reduced to counting fingers. The cornea was too steamy to give the fundus definition with the ophthalmoscope. He had walked the floor all night from severe pain. I determined to prepare the eye for operation by trying to establish an anterior chamber by use of a 1-grain solution of eserine instilled upon the cornea six times a day, and advised the use of the Japanese hot box for dry heat. The temperature of about 115° was kept up for two hours at a time and was ordered three times a day. The heat relieved the pain and by the next day I found the pupil contracting. The eye steadily improved until at the end of a week all congestion had disappeared, and with it all pain. Sight had returned as the congestion subsided, and to-day when I saw him there was no need of an operation at present. Sight is normal, congestion all gone, and, with the exception of a much-contracted pupil, the eye looks quite as well as the other, which was not affected. How soon there may be a repetition of the glaucomatous attacks in this individual case I am not able to say. I have other cases of two years' standing that I have relieved as promptly as in this instance and they remain cured. I am beginning to have so much confidence in the eserine and dry heat for the relief of acute glaucomatous attacks that I am quite ready to advise this treatment as a preparation for an iridectomy should the relief not come in a few days' use of the remedies. For convenience, cleanliness, and the very great advantage of keeping up the same temperature, I would call the attention of the section especially to the Japanese hot box, which is in universal use in Japan to relieve pain in all cases in which we apply moist heat. They can be found at all stores selling Japanese goods. The boxes, as we find them, not made for eye work, are about the size of the hand in length, breadth,

and thickness. A charcoal fire is used for heating. Under the slow combustion of the box it will burn for about two hours and will keep up a temperature of from 115 to 120°. I have had them in general use, both at my hospital and in private practice, for fully three years, and I know no substitute for them in any case of severe eye congestion, especially in glaucoma. Patients who have once used it fly to it for relief with confidence whenever the pain recurs.

In closing the discussion Dr. Dean said:

I am very glad that so much discussion has been elicited. And it was not to be expected that so learned a group of scientific gentlemen would accept all the ideas advanced unchallenged; it is not in the nature of things. My object was to start up trains of thought that might lead to useful results. My leading idea was to explain the underlying or predisposing cause of glaucoma: not to combat the operation of iridectomy as such. I believe in iridectomy in suitable cases, where the rapid reduction of tension is an urgent necessity. What I meant was that, by beginning early with suspicious cases, its application might be gradually circumscribed. I also ventured the prediction that it would be less often required in private practice as the people learned to take earlier and better care of their eyes, aided by the painstaking efforts of skilled oculists.

CATARACT EXTRACTION WITH THE IRIS RETRACTOR.

By FRANCIS VALK, M. D.,

Instructor, Diseases of the Eye, New York Post Graduate School and Hospital, etc.

Since the early part of 1887, I have performed the operation for the removal of cataract by a method somewhat different from that usually adopted. This I have placed before the profession at the Post-Graduate School, at the State society, and also at the meeting of the New York Academy of Medicine, but, owing to unforeseen circumstances, there has been no opportunity for my colleagues of New York City to criticise or to discuss the merits or demerits of the retraction of the iris, and the removal of the lens at the same time. I have, therefore, asked the honor and the privilege of bringing this matter before the congress, that it may meet with a full and a fair discussion. I shall always highly appreciate the opinions and suggestions of those who have entered this special branch of surgery, before I attempted to step on the first round of the ladder of fame, as well as the remarks of those who are working side by side with me in trying to advance this noble art, even though our efforts may not meet with the approval of all, still we hope these are but steps forward, if I may call them such, that they may some day fall into the hands of men who may so improve them as to produce far better results.

I do not propose to discuss the merits of the different methods for the removal of the sclerosed lens, which intercepts the rays of light, nor the special features of an operation with or without an iridectomy, as the advantages of a round and normal pupil are well known and obvious. Nor yet do I believe there will ever be a day when the conscientious surgeon will adhere strictly to only one method of operation, but will always adopt what he thinks best for the ultimate good of his patients. Therefore it is my intention in this paper to suggest some thoughts and methods that have occurred to me in the course of my limited number of operations and to explain the uses and advantages of the simple little instrument, "the iris retractor," that I have used whenever possible during the past four years.

As regards the time to operate. I think that this should be decided, when we find the cataractous lens sufficiently hardened to admit of its ready removal, without any reference to what the vision in the other eye may be. If our patients are willing to have an operation performed, even though the vision may be good in one eye, say $\frac{20}{70}$, then you are justified in taking the slight risk there may be of failure for the

benefit of the improved binocular field of vision. The blindness on one side renders our patients at a disadvantage, as some of my cases will show; at the same time we make a useless eye ready for practical vision, when its fellow lens become opaque.

Preparation for the operation.—We may do nothing as regards the ultimate success, except so far as we may have the minds of our patients completely at rest. In the light of the present statistics, the chances of failure in a healthy eye, if a cataractous eye can be healthy, are very small, as you may see by the reports of cases lately published. So I do not in any way prepare my cases beforehand, and particularly avoid the use of atropine before the operation.

Operation.—At the time when I am ready for the operation, I instill a sufficient quantity of a solution of cocaine, 4 per cent., to render the cornea anæsthetic, but not to dilate the pupil. The patient is then placed on a steady table or bed with a good clear light on the eye, and the lids opened with the speculum. The eye is then washed with a solution of boracic acid while my instruments are all placed in boiling water and then on a clean towel and covered until wanted.

Section.—This I consider the most important part of the operation, as upon a good section, I believe, depends the ultimate success. This should be in the same plane, except at the finish, as I shall describe. I wish to avoid the conjunctival flap, and by the perfect coaptation of the wound in the cornea we may avoid slow healing, septic infection, and prolapse or incarceration of the iris. I make the section either upward or downward, according to the eye to be operated upon, as upward in the right eye, downward in the left eye, or, if the operator is ambidextrous, then both sections may be made upward, as I consider the upward section preferable. I prefer, in making my section, to cut always towards myself, for in so doing we produce a much smoother and clearer cut. I always make the puncture and counter puncture wholly within the corneal tissue, through its transparent margin, about 1 millimeter from its periphery and so that the cutting edge of the knife will just cover the pupillary edge of the iris on the side toward which I propose to make the section. If possible I rapidly make the section of the cornea with three distinct cuts; first, carrying the point of the knife, as soon as the counter puncture is made, upward and forward, cutting one side of the cornea; then the heel of the blade is drawn upward and backward, so cutting the opposite side; then turning the knife on its long axis, the section is completed with the third cut by pushing the knife steadily forward until released. I think De Wecker, of Paris, first suggested this method, and I prefer it to all others. As I complete the section in the above manner the knife comes out some distance from the scleral junction, leaving room for the iris to be tucked in, when drawn back by the retractor. At this time we may have prolapse of the iris; if so, it must be returned with the spatula, if we wish to save the iris; but if not, then it may be drawn out and cut off, if we decide that an iridectomy is best. Another complication that may occur at this stage, particularly in very old people, is the rupture of the capsule or the zone of Zinn, with the presentation of the lens at the section; if so, it must be removed at once by pressure on the cornea. I am inclined to think that should there be any tendency to prolapse at this stage, it is better to perform an iridectomy at once, to prevent any future prolapse as the healing process proceeds. If no complications arise I then proceed to open the capsule by a peripherial incision, passing the cystitome inward to the pupillary space, then under the iris, and sweep it around beneath the edge, so as to cut the capsule in more than one-third of its periphery on the same side that the section has been made. My next step is the drawing back of the iris and the extraction of the lens.

At this point I wish to say a few words in reference to my method of the retraction of the iris with the little instrument called the "iris retractor," which I now present, claiming that I first adopted and practised this method. In the Archives of Ophthalmology, May, 1888, page 60, Dr. Herman Knapp states that, before and since I read my first paper on this subject, he had drawn back the iris toward its periphery when he found that membrane somewhat rigid, using the small wire

loop, but he does not state that he held the iris drawn back until the lens was removed, so I infer that he simply drew it back to relieve its rigidity, or to break up any adhesions that may have formed between the iris and the anterior capsule. Again, I find in an article by Dr. Barton Pitts, of St. Joseph, Mo., in the Medical Record of October, 1890, wherein he claims a method of operation by which he draws back the iris with the same wire loop which Dr. Knapp used, and held it there until the lens passed out by pressure on the cornea. In the same paper Dr. Pitts criticises my retractor, when, according to his own admissions, he has never seen my instrument, nor does he even know its construction, but has simply followed out my ideas of drawing back the iris and holding it tucked back until the lens is removed. He does not give me the credit of having first adopted that procedure, though his ideas may be original with himself.

I will quote Dr. Pitts's words:

By Dr. Valk a distensible shield with two knobs is proposed. The method of its manipulation is to insert through the corneal wound, cover the surface of the iris, and by the knobs holding in the pupil, retract the iris upward as far as necessary and slide the lens over the front surface of the shield. Dr. Valk reports good results with it. I have not tried it, nor am I familiar with its pattern except from description. I should think, however, it objectionable, on the score of occupying considerable space, already too limited. Its insertion, moreover, I think awkward, and in the event of sudden movement of the eye under operation its presence in the anterior chamber especially dangerous. * * * To overcome the resistance of the iris and frequent rigidity of the pupil, I have for two years resorted to the same instrument recently mentioned by Dr. Knapp as used by him: that is, a fine wire loop attached to a delicate handle. This instrument, which can be easily and thoroughly sterilized, I insinuate through the corneal wound into the pupillary space and retract the iris into the superior triangular space, and by a gentle pressure backward and upward of a strabismus hook applied against the lower edge of the cornea, I have little difficulty in the delivery of the lens and without material injury to the iris, and in no instance accompanied by loss of a single drop of vitreous, or followed by septic infection of the eye.

I have quoted his remarks thus fully, that you may note the different methods, and also if this little instrument is at all objectionable because it occupies too much space, or is especially dangerous in any sudden movements. I have never found it so; and in reality this retractor of mine does not take up any more room than the wire loop, nor is it "awkward" in any sense, as it can be easily removed from the eye by simply tipping up the ends of the blades, thus instantly releasing the iris. It seems to me that the construction of this little instrument is extremely simple, having only two small smooth knobs on the ends of a pair of forceps, with crossed action, and the size of the ordinary iris forceps. These little knobs, standing at right angles to the axis of the ends of the blades, and pointing downward, simply hold the iris tucked back in the superior triangular space until the lens passes into the corneal wound, when the iris is at once and easily released. When we consider the ease with which the lens passes out and the slight pressure required on the cornea, so much less than in the simple extraction universally adopted at the present day, I feel justified in claiming some merit and originality for this little retractor.

The eye being now ready for the extraction of the lens, it is grasped by the fixation forceps directly opposite the section, and held steady by a careful assistant. I now take the retractor in the left hand and with the blades closed and the set-screw so arranged that the blades will open to about the diameter of the pupil, I insinuate the ends through the section to the pupillary space. The blades are now opened by pressure and the iris drawn back and tucked beneath the edge of the lower corneal section. Holding it steady in that position, a slight pressure is made on the opposite side of the cornea, by a spoon or hook, causing the lens to rise up and easily pass out over the ends of the blades. As it does so, and as soon as the lens presents itself at the section, the retractor is pushed slightly inward, at once releasing the iris. The retractor is then generally removed, with the lens lying in the concavity of the blades. As the lens clears away we find the iris back in its position, not injured in

any way, nor has it been exposed to the air, as may occur in simple extraction. In case there should be any cortex remaining, which I do not think will be absorbed or will interfere with the vision, I have reïntroduced the retractor, and, drawing back the iris again, these masses are easily pressed out with the spoon.

This completes the operation, and the section being in perfect opposition, the speculum is removed, the eye gently closed, and the bandage applied.

After treatment.—There seems to be as much diversity of opinion as regards the method of after treatment of an operation at the present day as there is in the methods of operation, even so far as not to use any bandage or dressings of any kind. I note that Prof. Knapp does not close the eye until about half an hour after the operation, in order to see if there is any tendency of prolapse. He only applies the cotton and isinglass slips, while Chisholm, of Baltimore, does not even apply any cotton; but as I have watched the healing process of my cases and noted the different conditions under which my patients have, from necessity, been placed, I am inclined to think that it is best to take a happy medium with a decided modification of the old strict method in use some years ago. Our first consideration must be the ultimate success of the operation and next the daily comfort of our patients as the healing process proceeds. Bearing these two points in mind, it seems to me that there will be fewer movements of the eye, and consequently less pressure on the sclera by the straight muscles, if we close both eyes with a neat-fitting flannel bandage with pads of absorbent cotton over the eyes. The slight restraint of a day or two in bed will not cause any distress, while the rest and quiet will assist in the rapid healing of the large corneal wound. I do not doubt but that those who use modified dressings have as good success as can be wished for, though the above ideas seem to me the best that we may employ to complete the healing of our patients, according to the old motto *Tuto, cito et jucunde.* I remove the bandage from the eye not operated upon at the end of forty-eight hours, or on the second day, as I do not wish, nor do I see any need, to keep these old people in the dark any longer than is absolutely necessary.

In my last four cases I have tried to carry out my ideas of non-interference still further, as I sometimes think that atropine may irritate an eye which has been operated upon for cataract, and lately I have not used this drug unless necessary; that is, when there were indications of commencing iritis; but I have changed the bandage every twenty-four hours, washing the lids carefully and gently with warm water, applying a little vaseline to the edges of the lids, and then replacing the bandage.

Now I wish to make another suggestion in reference to that desire which we perhaps all have, to look at the eye and to see the result of our work. Is it not better to leave the eye alone until all possible danger of complications has passed? Some of us have noted an opening of the wound or prolapse of the iris as late as the sixth day after the operation. Therefore I have decided to simply change the dressings every day for about ten days, unless there are some indications otherwise, and then open the eye in a darkened room, gradually accustoming it to light by the use of smoked glasses.

Prof. P. D. Keyser, of Philadelphia, and Dr. W. Buss, of Bradford, Pa., have used my retractor in several cases, and have reported to me good results, each being pleased with the easy exit of the lens and the rapid healing of the wound in the cornea.

In conclusion, I do not think that the surgeon who considers the best interests of his patients and the various conditions that may arise during an operation for the removal of cataract will persistently adhere to any one method of operation. In my own cases I have been compelled to lay aside the retractor in four cases out of thirty-three. So the surgeon must adopt that method which to him at the time seems best for the success either with or without an iridectomy, but we can adopt some method and endeavor to carry it out, unless we find it will endanger the final results.

Some of my cases have required a subsequent discussion, but as each case of that kind requires special study and method in itself, I will not make any particular reference to it, except so far as I consider Dr. Knapp's remarks as to the operation, delivered at Detroit, as the best and giving the final results required.

In the following table I give the histories of 29 cases in which the retractor was used:

No.	Sex.	Age.	Name.	Eye.	Iris prolapsed.	Conditions, complications.	Results.	Remarks.
1	M.	35	Wm. C.	R.	No.	Traumatic	$\frac{20}{40}$ + $\frac{1}{4}$	
2	F.	55	Ellen C.	R.	Yes.	Senile	$\frac{20}{70}$ + $\frac{1}{3}$	Incarceration iris.
3	F.	55	do	L.	Yes.	do	Shadows	Do.
4	F.	60	M. A. L.	L.	No.	do	$\frac{20}{50}$ + $\frac{1}{3}$	
5	F.	60	May W.	L.	No.	do	$\frac{20}{40}$ + $\frac{1}{4}$ ⊂ + $\frac{1}{10}$ c. ax. 180°	
6	F.	72	Sarah C.	L.	No.	do	$\frac{20}{30}$ + $\frac{1}{3}$	Discission, 6 months.
7	M.	35	Patrick K.	R.	No.	Immature	$\frac{20}{70}$ + $\frac{1}{3}$ $\frac{1}{2}$	Incarceration iris.
8	M.	53	Antonio L.	R.	No.	Senile, black	$\frac{20}{40}$ + $\frac{1}{4}$ ⊂ + $\frac{1}{16}$ c. ax. 90°	
9	M.	53	do	L.	No.	do		Successful, but no final test.
10	F.	30	Dora A.	R.	No.	Synechia, soft	$\frac{30}{100}$ + $\frac{1}{4}$	Spec. iritis before operation.
11	M.	50	Italian	R.	No.	Dislocation, up	$\frac{20}{100}$ + $\frac{1}{3}$	Vitreous lost.
12	M.	33	Bernard C.	R.	No.	Soft	$\frac{20}{40}$ + $\frac{1}{4}$	
13	M.	50	Dennis L.	R.	No.	Glaucoma, simp.	V = 0	
14	M.	50	Patrick L.	L.	No.	Senile	$\frac{20}{50}$ − $\frac{1}{3}$	Incarceration iris.
15	F.	66	Mary C.	R.	No.	do	$\frac{20}{40}$ + $\frac{1}{3}$	Discission, 6 weeks.
16	F.	66	do	L.	No.	do	$\frac{20}{70}$ + $\frac{1}{3}$	Incarceration iris.
17	F.	70	Margaret R.	L.	No.	do	V = shadows	Iritis, plastic, tenth day.
18	M.	50	Henry C. T.	R.	No.	do	$\frac{20}{40}$ + $\frac{1}{4}$	Discission, 4 weeks.
19	M.	55	Isadore T.	L.	No.	do	$\frac{20}{50}$ + $\frac{1}{3}$	
20	M.	50	Michael M.	R.	No.	do	V = shadows	(!)
21	M.	70	Geo. S. B.	R.	No.	do	$\frac{20}{40}$ + $\frac{1}{60}$ ⊂ + $\frac{1}{12}$ c. ax. 180°	Discission, 5 months.
22	F.	70	Miss B.	L.	No.	do	$\frac{20}{30}$ + $\frac{1}{6}$ ⊂ + $\frac{1}{18}$ c. ax. 180°	Vitreous lost.
23	F.	77	Minnie H.	R.	No.	do	$\frac{20}{100}$ + $\frac{1}{4}$	
24	F.	77	do	L.	No.	do	V = shadows	Iritis, plastic.
25	M.	74	Anton M.	R.	No.	do	$\frac{20}{50}$ + $\frac{1}{6}$ $\frac{1}{2}$ ⊂ + $\frac{1}{11}$ c. ax. 180°	Discission.
26	F.	54	Julia B. F.	R.	No.	Congenital, partially absorbed.	$\frac{30}{100}$ + $\frac{1}{4}$	
27	F.	47	C. H. B.	R.	No.	Senile	$\frac{20}{40}$ − 12 D	
28	M.	58	F. R. H.	L.	No.	do	$\frac{20}{40}$ − 10 D ⊂ 4 D 180°	
29	F.	55	C. D.	R.	No.	do	$\frac{20}{30}$ + $\frac{1}{4}$ ⊂ + $\frac{1}{10}$ 18°	Discission, 6 weeks.

Final results: $\frac{20}{20}$, 1; $\frac{20}{30}$, 2; $\frac{20}{40}$, 8; $\frac{20}{50}$, 5; $\frac{20}{70}$, 3; $\frac{30}{100}$, 4; shadows, 4; no result, 1; no test, 1; total, 29.

In all these cases I have used the retractor, though some of them have presented indications almost against its use; but the final results have seemed equal to that of any other method, while in four cases not reported I could not use the retractor and the final results were not as satisfactory, and in one case where I performed an iridectomy the end was total loss. This method is perfectly safe and the retractor can, if necessary, be quickly and easily removed from the eye, while the objection once raised, that it is another instrument introduced into the eye, is not tenable, as this instrument is so easily sterilized; and besides I think there is less manipulation of the iris than in simple extraction, particularly if the iris is prolapsed at the exit of the lens. I will close by stating that by this method I do not meet with any more accidents or risks, as loss of vitreous, etc., than usually occur by other methods. I believe that with the careful use the retractor, as I now present it, and as I have used it for the past four years, material service will be rendered to the ophthalmic surgeon in the removal of the cataractous lens.

This instrument may be procured from E. B. Meysowitz, of New York City.

HÆMORRHAGIC GLAUCOMA: ITS NATURE, PROGNOSIS, AND TREATMENT,

By S. D. RISLEY, M. D.,

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Case 1. Hæmorrhagic retinitis; secondary glaucoma; iridectomy; paracentisis and second iridectomy; enucleation.—April 22, 1884, Mr. E. W. G., æt. 53, a merchant from the interior of Pennsylvania, a tall, spare man with iron-gray hair and swarthy, opaque skin, consulted me regarding the rapid and serious failure of vision in his right eye. His general health was much impaired, which he ascribed to financial troubles followed by tedious litigation, which had disturbed him very much and left him, according to his own statement, a nervous wreck. This had occurred eight years before, since which he had suffered more or less with impaired digestion and extreme nervousness, with spells of great mental depression. His hands and head were in a state of constant agitation, as in progressive palsy. The reflexes were normal and he was free from pain. The urine was acid, but exhibited no trace of albumin or sugar, but at intervals deposited copious quantities of red sand. The radial arteries rolled rigidly under the finger, but there was no gross lesion of the heart, although he was readily winded on the slightest exertion. He had not suffered from what he recognized as gout or rheumatism. O. D. V. = Counting fingers at 0.50 m. Tension normal, no contraction of field. O. S. + 3 D. V. = 6/vi. Tension and field were normal.

The ophthalmoscope revealed in O. D. a plainly vascular iris and small pupil; H. + 3. D., small, dark-red optic nerve with indistinct margins, and scattered throughout the eye ground were innumerable small hæmorrhages, some of which were flume-shaped with fimbriated extremities, while many others were simply minute red points. The arteries were small and exhibited gray and ragged margins as far as they could be traced into the periphery of the eye ground. The light streak was for the most part absent. The veins were relatively large and full, their margins gray, and exhibited the light streak far more than the arteries. No aneurismal dilatations were noted.

O. S. H. = 3. D. The general condition of the eye ground was much the same as in the right eye, but there were no hæmorrhages and the disparity in the size of the arteries and veins was less marked. The pupils in both eyes were small and dilated on by small medium under homatropine. The serious nature of his trouble was explained to him and an unfavorable prognosis given. His daily life was carefully regulated, the diet restricted, exercise in the open air enjoined, and he received potassium iodide in increasing doses. A saline water was to be taken in sufficient quantities to keep the bowels in a lax condition. In two days he returned much encouraged by the improvement in his general condition and his vision had risen to $\frac{1}{24}$. There were no new hæmorrhages and the eye ground was less deeply red. The treatment was continued and he received, in addition, a weak solution of eserine sulphate to be instilled in each eye night and morning. In one month he had gained 15 pounds in weight, but his vision had made no further improvement. The tension in the right eye was questionably increased, but the hæmorrhages had largely been absorbed. The field of vision remained normal. He was then taking 20 grains of the potassium iodide three times daily and this, together with the eserine, was continued. One month later, on May 25, the right eye became painful, which he attributed to a severe cold he had taken. The eye was not red, but subsequently became so, and the pain became so severe that he at once set out for the city. The eye was found a cinnabar red, the cornea steamy and insensitive, and the ball stony hard. The pupil was small and fixed, and the iris was plainly vascular. There was no change in the left eye, v = 6/vi. A stronger solution of eserine was freely instilled and blood extracted from the temple. After the extraction of the blood, notwithstanding the free use of eserine, the pupilary diameter promptly increased to 4 mm. No view of the fundus was obtainable. The following day he reported great relief from the treatment, which lasted until after midnight, when the pain returned with great violence. Blood was once more taken from the temple and iridectomy advised. This was promptly done; the operation, notwithstanding the shallow chamber, was fortunately smooth, but the hæmorrhage following the excision of the iris was profuse and persistent, so that in the end the eye was closed, with the anterior chamber filled with blood. The wound healed promptly and the blood clot slowly absorbed. The tension became normal once more and the pain was entirely relieved. In two weeks Mr.

G. returned to his home with the eye white, free from pain, but totally blind, notwithstanding which he was very thankful for the relief experienced and the once more rapid improvement in health which followed. On the tenth day after his return home he suffered a severe attack of cholera morbus, accompanied with violent emesis and purging, which greatly weakened him. In twenty-four hours after the attack the iridectomized eye became uncomfortable, the discomfort rapidly developing into severe, unendurable pain, which, on the fourth day, once more drove him to the city for relief. The eye once more presented the cinnabar injection, characteristic of the glaucomatous eye, was stony hard, and the anterior chamber occupied by a large blood clot. He was suffering greatly and was completely broken in health. Enucleation was pointed out as the only sure source of relief, but to this he strenuously objected. Eserine and local depletion gave no relief, and so paracentisis of the cornea was done, affording instant freedom, except from a dull periorbital pain, the relief continuing for several days and T. + 1. In a week the symptoms were upon him again with a new clot in the anterior chamber. He still refused enucleation, and with full understanding of the uncertainty of relief, submitted to a second iridectomy, which was made below with a Graefe knife resulting in a broad coloboma well placed. To my own surprise this also healed kindly, afforded complete relief for six days, when he received a telegram announcing the death of a favorite grandchild, which greatly depressed him. The following day he had an attack of acute indigestion, which in turn was followed once more by increased redness of the eye and pain; the tension, which had been subnormal after the second iridectomy, became too high, but the ball not stony hard, as before. The symptoms steadily increased in violence for several days, but were relieved by the digestive derangement ending in a profuse diarrhœa with many liquid stools. The relief was only transient, however, and after suffering several recurrences of pain, accompanied each time with fresh hæmorrhage into the anterior chamber, he gave up the fight and submitted to enucleation on August 9, rather less than four months after the first-noticed impairment of vision. Mr. G has been seen from time to time since 1884, but at no time were hæmorrhages detected in the left eye, although he had frequent alarms by spells of imperfect vision. A letter dated July 17, 1893, says, "My left eye has been good until last March, then the sight became very dim; could not read, but is now much better; can read with ease and comfort."

Case 2. Hæmorrhagic retinitis; secondary glaucoma; iridectomy; enucleation; followed in six years by similar attack in other eye; iridectomy; total blindness. — On May 15, 1884, Mr. O., æt. 65, came to me bearing a note from his physician, Dr. Hinkle, stating that two months before he had had an attack of retinal apoplexy; that his urine on several occasions had contained traces of albumin, but lately this had disappeared. He had had several attacks of vertigo, but none within the past two weeks. His treatment had been antiphlogistic, with care as to his diet, rest, and iodide of potassium.

Mr. O. was actively engaged and much engrossed by the details of a large business, and lately had been much troubled over its uncertainties and by the sudden and unaccountable disappearance of a son. He was about 5 feet 6 inches in height, entirely bald, weighed about 250 pounds, had a florid face, and although an abstainer from alcoholic beverages, was extremely intemperate at the table, eating large quantities of richly prepared foods, not hesitating to wash his roast beef into his stomach with quantities of milk. His temper was extremely aggressive and his manner always that of command. His career had been one of many vicissitudes, having been driven as a Union man from one of the border States during the war, at the sacrifice of a large fortune, which at æt. 65 he was struggling with might and main to recover. In March, 1884, after spending an entire morning in his counting room reading and answering letters, noticed, on getting into the street, that his vision was defective, and the following evening the sight in the right eye had sunk to the ability to tell light from darkness. He consulted an oculist, who advised him of his apoplexy of the retina and gave him an unfavorable prognosis both as to vision and health. Under the wisely prescribed regimen and the potassium iodide prescribed by his physician, Dr. Hinkle, he had lost 14 pounds in weight.

St. Pro. O. D. No perception of light; ball stony hard; cornea steamy and insensitive; deep ciliary injection; shallow anterior chamber; pupil 4 mm. There was profuse lachrymation, and the eye was kept closed as though from photophobia; violent pain in the eye and severe hemicrania. No view of fundus admissible.

O. S., white, free from pain, anterior chamber shallow, pupil small, T. +?., Hm. = 2.50, D. V. = 6/ix. Optic nerve gray, and at its upper part a few small, reddish points, probably absorbing hæmorrhages. The pupil was too small to

permit of a satisfactory study of the macula lutea. There was concentric narrowing of the field to 30°. There was periodically a profuse deposition of uric acid and he was subject to fits of despondency and irritability. The radials were rigid, but no serious lesion of the circulation was discovered other than that existing in the retina. The serious nature of his trouble and the threatened onset of disease in the left eye were pointed out. Locally eserine, and leeches to the temples were directed. Free purgation and a rigid diet list, with exercise in the open air and entire absence from business and even moderate use of the left eye, were insisted upon. Two days later the pain was less and the steamy condition of the cornea had diminished. Iridectomy was then made upward, a broad coloboma well back being secured notwithstanding the great difficulties presented by the shallow anterior chamber. The aqueous was allowed to escape slowly, but profuse hæmorrhage followed the excision of the iris, and the eye was bandaged, with the anterior chamber filled with blood. The pain was at once relieved, but two days later the lids were puffy, the blood clot still present, and the wound open. The eye recovered slowly, with a filtration cicatrix. There was no return of pain, but there were frequently recurring hæmorrhages in the anterior chamber until August 8, two months after the iridectomy, when, after consultation with a colleague, he consented to enucleation. He was urged to continue his general regimen as directed, under the care of his physician, and disappeared from observation. In the left eye vision remained as at first, possibly with some improvement, but no change in the field and no new hæmorrhages.

In June 1890, six years later, Mr. O. returned greatly alarmed over the diminished sight in the remaining eye. He had had repeated attacks of transient dimness of vision, from which he would slowly recover, but the present attack was worse and persisted. He had no pain, with + 2.50, V. = 6 / xviii, Tn (+ ?); pupil small, anterior chamber shallow, iris apparently healthy, cornea and deeper media clear; F. narrowed concentrically to 26°, and a notch out of the lower temporal field extending quite up to the fixation point. Pupil was too small to permit of satisfactory examination of the eye ground, so a drop of 4 per cent solution of cocaine was instilled. The dilation secured was but little. The fundus was found studded with numerous minute hæmorrhages, the arteries small, veins only relatively large, a doubtful cupping of the nerve, which is gray and obviously the subject of a slowly progressing atrophy. He was apprised of the fact that he had much cause for alarm in the presence of the optic-nerve atrophy, the retinal hæmorrhages, and his general dyscrasia. The arterial sclerosis had evidently advanced during the intervening years, and he was subject to fits of indigestion if he did not exercise care in eating. The portentous character of these retinal leaks was explained as showing the condition of the general blood-vessel system and warning him of the importance of moderate indulgence at the table and of a carefully regulated life. Blindness was pointed out as sooner or later inevitable, which he himself felt must be true after his experience with the other eye. Consultation was requested, but this he refused. Potassium iodide was administered and the instillation of eserine resumed. In a week vision rose to 6 / ix, and he said he could move about with less difficulty. The middle of July he went to the New England coast for the summer, and was not seen again until September 20. V. had fallen to 6 / xix. Field as before, and there were numerous flame-shaped hæmorrhages, with many red spots dotted over the fundus; he saw to get about with difficulty. His daughter related that he would pay no heed to his diet, was self-willed, and in spite of remonstrance would drink glass after glass of milk with an otherwise full and rich meal. Even at the seaside had worked incessantly at his business by telegram, correspondence, and otherwise. Consultation was again requested, but declined. Under purging, eserine, rest, and ascending doses of the iodide of potassium and corrosive sublimate his vision once more improved. October 11 V. 6 / ix, and the hæmorrhages were disappearing. His wife was then taken critically ill, which quite unnerved him, and his eye grew rapidly worse. A pronounced glaucoma now supervened; ball stony hard. His wife died at this very critical juncture, and after her burial the field was found contracted to central vision, and only the large letters on the test card could be made out by searching, at 2 or 3 feet. The pain, not severe at first in his stunned condition, steadily grew worse. That blindness was inevitable was only too plain, but at his request, and after carefully explaining that it was a forlorn hope, an iridectomy was successfully made upward, securing a typical and well-placed coloboma, notwithstanding the difficulties presented by the shallow anterior chamber. There was much bleeding, but the wound healed kindly and the tension was restored to normal, or possibly subnormal. There was no return of pain, but the eye remained red a long time and vision was slowly lost, probably from atrophy of the nerve or possibly from repeated hæmorrhages in the bottom of the eye.

He was last seen in April, 1891; then totally blind, free from pain, the eye nearly white, and the tension slightly subnormal. He came to reproach me with having been the occasion of his blindness, after a consultation had with another surgeon in a distant city, whose views he must have misunderstood. I can scarcely think it possible that any experienced surgeon would ever say that an eye with hæmorrhagic glaucoma had been lost through a colleague's neglect.

Case 3.—Hæmorrhagic retinitis; secondary glaucoma; blindness.—Mrs. X., æt. 70, was brought by her son, a physician, for rapidly failing vision in both eyes. Vision had sunk to 6/xxx in O. D., and to counting fingers at 2 feet in O. S. She had no pain, but said her eyes were weak and had been failing her for a long time. The anterior perforating vessels were all dark-colored and large; the caruncles were swollen. There is no note regarding the state of the pupils or anterior chamber. O. D. media were transparent, and there were innumerable small hæmorrhages dotted over the fundus. The nerve margins were veiled; no cupping; marked perivasculitis. O. S. spicules of opacity in periphery of lens; details of fundus blurred by state of vitreous, but here also marked perivasculitis. No cupping of nerve; hæmorrhages in retina more numerous and larger, and involving macular region more seriously than in the right eye. There is no record of the field of vision. In both eyes the sclera are rigid. The patient was a tall, spare woman, with dark, opaque skin, iron-gray hair. Her manner was one of anxiety and distrust. There were gouty concretions in her finger joints, and the hands were distorted. Says she has suffered much from rheumatism. Urine had high Sp. Gr. and trace of albumin. Had been told her eye trouble was glaucoma, and her son brought her for an iridectomy. He was disappointed when a grave prognosis was given both as to general health and the probable results of any local treatment. Operation was advised against, and her general regimen carefully directed; potassium iodide was prescribed internally and eserine locally, while complete rest of the eyes and life in the open air were enjoined. The son was not satisfied with this conservative advice and sought the opinion of an eminent colleague in Philadelphia, who also advised against operative procedure. Still other opinions were sought until the desired advice was received and an iridectomy performed on the left eye after a very encouraging opinion had been given regarding the brilliancy of the results of iridectomy in glaucoma. The wound refused to heal; there was a succession of hæmorrhages into the anterior chamber, each time attended with pain. In this condition my advice was sought again, and the above history obtained; but I declined to direct them farther, as they were making vows of vengeance against the doctor, who had probably mistaken the nature of the case, not being able to study the eye ground as I could do a month earlier in its history, and during the hæmorrhagic stage.

I am inclined to offer my excuse for calling attention to the gloomy clinical picture presented by hæmorrhagic glaucoma. I confess it would have been a more pleasing task to have invited the section to the consideration of some form of disease which experience has taught us to assail with some hope of a successful issue. The serious prognosis which must be given in this disease, however, makes it all the more important that ophthalmic surgeons should entertain more or less uniform views as to its essential gravity and its relation to other forms of eye disease in which increased intraocular tension is a characteristic symptom.

Inspired by the brilliant results of surgical procedure in primary glaucoma, the surgeon who has been fortunate enough to escape experience with this fortunately somewhat rare disease may be led into a too hopeful prognosis. It is important, therefore, that a line should be drawn, as definitely as may be, between hæmorrhagic and primary glaucoma, since on the one side lies a hopeful prognosis, while on the other both experience and pathology join hands to teach us the limits of our art. It was my purpose to make a careful study of the literature of this subject, but the recent excellent contribution of Bourgon has rendered that unnecessary. I must acknowledge my appreciation of the services rendered in this by Dr. A. G. Thomson.

My interesting, although forbidding, experience with this disease, the serious nature of which I did not at first fully appreciate, has prompted to a more careful study of the disease and to a comparison of my own experience with the published records. While this collective study has served to remove the tendency to self-reproach for the unfortunate outcome in the cases here reported, it is to be regretted

that it has also failed to inspire with greater courage or added hopefulness should further responsibilities arise.

A comparatively rare affection.—There is cause for congratulation, however, in the comparative infrequency of the disease. In 20,000 eye patients I have seen but 4 cases, and several of my colleagues with large experience report by letter that they have never met with a case. In 464 glaucomatous eyes reported by Knapp but 9 of them were classified as hæmorrhagic, and Bourgon, in his elaborate paper, places its occurrence at one case in 6,741 patients.

Prognosis.—It presents, however, a most gloomy picture, since, no matter what form of treatment is adopted after the glaucomatous stage of the disease is reached, it goes on to a fatal issue so far as vision is concerned. Thus, in 20 cases, comprising 24 eyes, all resulted in total loss of vision and 20 of the eyes were subsequently excised. The cases referred to are 1 by Norris, 1 by Kollock, 3 by Randolph, 2 by Nettleship, in all of which effort had been made to save the eyes. Then 1 each by Pagenstecher and Deutschmann, 2 by Brailey and Edmunds, and 2 by Bourgon, and 1 each by Wadsworth and De Schweinitz, in which enucleation was performed primarily. Bourgon, however, in detailing the results of iridectomy in 24 cases, records 16 failures and 11 enucleations. In reply to a private letter Wadsworth reports 1 case in which both eyes, with an interval of a few months, were the subject of this disease. The first eye was primarily excised and one had sclerotomy performed, which gave only temporary relief and was subsequently enucleated. Ayres also reports by letter 2 cases, one of which was enucleated after iridectomy had proved futile, and De Schweinitz 2 cases, 1 iridectomized and subsequently enucleated and 1 primarily excised. In the 3 cases here reported from my own private practice 4 eyes were involved, all proving fatal to vision, notwithstanding general therapeutics and operative measures in all. Two of the balls were enucleated and two passed from observation. It will be difficult to find a clinical picture with a darker background of prognosis than is here presented by hæmorrhagic glaucoma. The terse but unfavorable prognosis given in all our text-books are too well known to require repetition here.

Schweigger, e. g., states the general sense of classified treatises on diseases of the eye in the following language (Handbook of Oph., p. 52):

> The results of iridectomy are generally unfavorable in those cases of secondary glaucoma which have developed after retinal hæmorrhages. In such cases vision is frequently greatly impaired by the hæmorrhages, and is irrevocably lost by the glaucomatous disease. But if severe and continuous pain remains, which yields to other treatment, nothing can be expected from iridectomy, and it only remains to enucleate the eye.

Pathology.—A grave prognosis, however, was to have been anticipated from a study of the general and local pathological conditions present in most of the patients who are the victims of this fell disease; so that, indeed, not only is vision surely lost, but the general prognosis is scarcely less grave than the local. While comparatively few deaths have found their reports in ophthalmological literature, it is nevertheless likely that in some cases the subsequently fatal ending would be known only to the general physician. The fact which is patent to us all, that of the numerous cases of retinal hæmorrhage we are called upon to treat a very small number ever develop glaucoma, is in a part at least accounted for by the fact that fatal apoplexies occur before the glaucoma has had time to develop, since it not infrequently happens that many months, and in some cases a year or even longer, may elapse between the occurrence of the retinal hæmorrhages and the onset of the glaucoma, in which time fatal intracranial apoplexies may and do occur. In other cases the results of treatment and an improved regimen may be effectual in restoring a more favorable state of health and by this means ward off both the glaucoma and the fatal apoplexy. That glaucoma does not follow most cases of

retinal hæmorrhage, or comes on only after prolonged intervals, may be due in part to the fact that hæmorrhages are more likely to occur at the beginning of the sclerosis of the vascular walls, as pointed out by Thoma and quoted by Bull, as follows:

In the beginning of the process there is a loss of elasticity of the vascular walls, shown in life by a soft, high pulse, and pulsation and tortuosity of the arteries, notably the arteries of the retina. At this stage there is the greatest danger of rupture of the arteries; later the vessels, by reason of the deposit of connective tissue in the intinia become firm and rigid.

As the constitutional conditions upon which the retinal lesions depend, advance the general impairment of the nutritive processes increases in the eye as elsewhere. Under the irritating presence of the hæmorrhage in the retina and the disturbed nutrition of the eyeball, brought about by interference in its circulation, we recognize those conditions which readily lead to a disturbance of secretion and excretion, and probably pathological changes in the region of the canal of Schlemm. In the case reported by Norris (Trans. Am. Oph. Soc., p. 476, Vol. IV) there were hæmorrhages in the sclerotic and in and around the canal of Schlemm.

Edmunds and Brailey (Royal Oph. Hos. Reports, Vol. IX, p. 380) point out that in pure glaucoma cases there is almost without exception a most important change in some or all of the intraocular blood vessels. This consists in a great enlargement of their caliber, consequent on their dilatation, and is accompanied in the majority of cases by a thinness of their walls, due to actual atrophy, and these changes are characteristic of glaucoma. In 17 cases of hæmorrhagic glaucoma microscopically examined by Edmunds and Brailey (*loc. cit.*) the arteries were found thickened in all but one. In Randolph's case (Trans. Oph. Sec. Am. Med. Ass., 1891) there was found hyaline degeneration of the muscular coat of the central artery and the veins of the choroid enormously distended, while endarteritis was apparent in several of the smaller arteries. Bernbacher and Czermak always found in glaucomatous eyes the products of inflammation along the intraocular veins and around the veins of Schlemm's canal. Dobrowolsky observed comparatively frequent periusculitis. Brailey (*loc. cit.*) says while arterial hypertrophy may be associated with general disease, as in Bright's, diabetes, or syphilis, it may also be a purely local affection, as in cases of glaucoma following injury where a similar condition of the blood vessels was found.

It is obvious, therefore, that the onset of glaucoma in apoplectic retinitis is determined by purely local conditions, which in certain cases is favored by a rigid sclera, or by retino-choroidal states brought about in hyperopic or astigmatic eyes, or by many other conceivable conditions, while in the absence of these favoring conditions the glaucoma may never occur; or may supervene only after the lapse of time, the irritating presence of the hæmorrhages, and the advancing pathological state of the blood vessels, steadily producing the local conditions shown to be characteristic of glaucoma. In a word, therefore, we must regard the glaucomatous symptom as secondary to the hæmorrhages, and more or less strictly dependent upon the accompanying local pathological states. The graver character of the glaucoma of the hæmorrhagic variety seems to grow out of its association with systemic conditions, of which it forms but a local expression.

Regarding the existence of general arterial disease many of the reports are silent. In my own cases they were all subjects of general arterial sclerosis, and in many of the reported cases the existence of general vascular disease is either distinctly noted, or the existence of albuminuria, sciatica, as in Randolph's case, or other symptoms of general disease were present, which rendered the existence of arterial disease highly probable. In two of my own cases the gradual progress of the general vascular disease was observed as the years went by. Both of these patients were victims of lithæmia and suffered repeated acute exacerbations of the accompanying digestive derangements, each time followed by an increase of the ocular

symptoms. In Dr. Wadsworth's case, however, he is careful to note the absence of any other than a local cause. The most recent and one of the most valuable contributions to the important rôle played by systemic disorders in causing ocular disease is a paper by Dr. Bull, read in July last, before the American Ophthalmological Society, on "Gouty retinitis, chorio-retinitis, and neuro-retinitis." Although there were retinal hæmorrhages in but one of the five cases upon which his paper is based, nevertheless, the eye ground changes described by him are much the same as those observed in hæmorrhagic retinitis, barring the presence of the hæmorrhages. This is especially true as regards the appearance of the blood vessels; namely, the white line along vessels, the result of peri-vasculitis or sclerosis.

The clinical facts connected with retinal hæmorrhages therefore justify the ophthalmic surgeon in the gravity of the prognosis given to patients who come with these lesions. In the case reported by W. F. Norris, which I also saw throughout its course, death followed from apoplexy one year after the eye had been enucleated. Von Graefe, Rampoldi, Brailey and Edmunds, Hirshberg, and others have observed cases of hæmorrhagic glaucoma followed by symptoms of intracranial hæmorrhage with a fatal issue, and Dr. J. A. White kindly reports by letter two cases of hæmorrhagic glaucoma, both of which died from apoplexy. This he puts forward as supporting his view that the whole trouble is due to atheroma of the arteries. We are therefore justified not only in giving a grave prognosis as to the loss of vision, but also as to a probable fatal issue.

In answer to a circular letter addressed to a few of my ophthalmological friends I have received the following replies. Dr. J. L. Thompson writes:

I have met with many cases of this disease, and in every instance have found that the glaucomatous symptoms were set up months and in some instances as long as two years after the hæmorrhages were first observed. I have watched these cases from time to time, some of them with marked impairment of vision, others with but slight, but without pain or increase of tension, for from six months to two years, but have eventually had to enucleate these eyes on account of the excessive pain. The long experience which has enabled me to watch these cases through all their phases has convinced me that hæmorrhagic glaucoma is a secondary affection in at least the great majority of instances. Eserine sometimes helps them for a short time. Iridectomy or sclerotomy are certainly contraindicated, but enucleation often has to be resorted to.

Dr. G. E. de Schweinitz writes:

It seems to me that hæmorrhagic glaucoma is always a secondary glaucoma, and no doubt depends, in the first place, on the hæmorrhagic retinitis which precedes it, and in the second place on the constitutional disturbance which determines the lesion in the retina. I have performed iridectomy on only one such case. Twenty-four hours after the iridectomy there was a fresh intraocular hæmorrhage and a prolapse of the vitreous into the wound. Curiously enough, after the abscission of this prolapse, the wound healed nicely and the patient was relieved from pain, although the eye was sightless. It seems to me that Bourgon's conclusion is a good one, namely; that during the hæmorrhagic period the general condition should be cared for and the ocular globe rendered as free from congestion as possible; during the period of confirmed glaucoma myotics are useful as well as moist heat. If surgical measures were called for, I would do either tapping of the vitreous or sclerotomy, but I would not perform iridectomy. I would do neither of these operations without previously obtaining the consent of the patient to perform enucleation if I failed, or if not enucleation, one of its substitutes. In a second case, which occurred only a few weeks ago, remarkable relief followed general medication, such as I have indicated, and, in addition, full doses of chloral, which I believe has some influence in lessening tension. In spite of this, however, there was a fresh attack at the end of a month, and the eye was enucleated at the patient's request, the eye being practically sightless. Microscopically the lesions were those of an exquisite example of hæmorrhagic retinitis.

Dr. F. C. Hotz refers to a published case (Ophthalmic Record, Vol. II, p. 234), and writes:

The affection I have no doubt begins in the retina; the glaucomatous symptoms are secondary, and no kind of operation will save the eye.

Dr. O. F. Wadsworth writes:

To obtain any definite idea of the etiology of hæmorrhagic glaucoma it must be shown why in some eyes hæmorrhage in the retina or vitreous is followed at greater or less interval by glaucomatous symptoms, in others not. In my opinion scarcely any approach has been made to the solution of this question. Probably the etiology is not always the same. Such a case as the following seems to preclude other than a local cause. A lady beyond middle life presented hæmorrhages scattered all over the retina of one eye; in the course of the year, glaucoma and enucleation; some months later sight of second eye lost with similar subjective symptoms; eventually glaucoma; sclerotomy, which helped for only a few days; enucleation. Careful examination failed to discover disease of any other organ. The lady lived some twelve years from the time of hæmorrhage in the first eye and died of acute pneumonia. As to prognosis, it is generally fatal, not simply as to sight; that is, as a rule, practically gone before the glaucoma appears; but as to the existence of the organ. In rare cases pain and symptoms subside and do not recur; usually enucleation is necessary to free the patient from continued pain. Both iridectomy and sclerotomy have failed in my hands to relieve pain for more than a very brief time. Still, if enucleation were specially repugnant to the patient I should try sclerotomy, but with the distinct understanding that it probably would have only a transitory effect.

Dr. Joseph A. White writes:

My opinion is, that the whole trouble is due to atheroma of the arteries. Two of my cases of hæmorrhagic glaucoma died of apoplexy, rather supporting the theory, because the eye and the brain are the places where the arteries are the most exposed, and liable to rupture.

Dr. S. C. Ayres says:

In relation to this disease I will say that I have been very fortunate in not meeting many such cases. The most striking case is that of a woman where the iridectomy was successfully done and I was called to her in a few hours, suffering intense pain. On removing the bandage I found the entire vitreous extruded and the globe partly filled with blood. I immediately enucleated the eye. In another case the globe partly filled with blood after iridectomy, and I think remained sensitive for a long time. In a severe case where the vision was lost, or nearly so, I should recommend enucleation. The after results of operation are so unsatisfactory that enucleation is frequently necessary even after well-executed iridectomy.

Dr. Swan M. Burnett speaks of it as a truly terrible disease, and regards himself fortunate in having seen but two cases.

Dr. Leartus Connor:

I have never seen a case of hæmorrhagic glaucoma in my own work, but have been led to regard the disease as primarly due to a degeneration of the blood vessels.

Dr. Edward Jackson reports two cases in which general therapeutic measures proved of value, but the ultimate results were not known. His feeling is against operation, but would operate if desired, after full explanation of the prospects, and decides in favor of posterior sclerotomy rather than iridectomy or anterior sclerotomy.

Treatment.—The views which have been expressed regarding the nature of hæmorrhagic glaucoma, together with the grave clinical picture which it presents, therefore fully justify a serious prognosis, not only as to the almost inevitable loss of vision and the sacrifice of the eye itself, but also to the possible fatal issue. My own judgment and experience are fully in accord with the recommendation of Bourgon (*loc. cit.*) regarding the treatment of the disease. Following his admirable clinical division we will discuss its treatment during the two characteristic periods it presents. First, a hæmorrhagic period; second, a period of confirmed glaucoma. During the hæmorrhagic period our care must first be devoted to the general condition of the patient, and second to remove the congestion of the eyeball. No scheme could be better than this as a working therapeutic basis.

Our only hope for the preservation of any vision must be based upon our efforts

during the hæmorrhagic stage of the disease. Having in mind the fact that the majority of these cases are victims of general arterio-sclerosis, and the diathesis which has produced this state of the general vascular tree, the therapeutic measures to be adopted are such as are properly directed to the treatment of the existing diathesis, whatever it may be—gout, rheumatism, syphilis, morbus Brightii, diabetes, or chronic malarial disease, and the allied pathological states of the heart, liver, kidneys, or spleen. To this end the patient's daily life must be controlled. The hours for rest and the amount and kind of exercise and a carefully arranged dietary are of great importance. Potassium iodide and bromide, or in some cases iodide of iron, corrosive sublimate in small, frequently-repeated, and long-continued doses should be administered. In hæmorrhagic retinitis, with traces of albumin and granular or hyaline casts in the urine, I usually employ the Basham's mixture, with the corrosive sublimate added, and avoid the iodine salts. If the turgid state of the choroidal circulation is marked, and headache a prominent symptom, I have for many years employed ergot, often with much relief. If there is cause to suspect the existence of malarial poisoning, quinine should be given, either alone or with arsenic. In this connection the following case is of interest:

A lady, aet. 46, had recurring retinal hæmorrhages, extending over a year and a half, with now and again increase of tension and pain. The blood contained the corpuscles of Laveran, and she lived in a malarial region. The increased tension and pain were relieved by eserine and local bleeding and she received quinine and arsenic internally, and was sent to the seashore. The retinal hæmorrhages ceased to recur after six months, and she returned to her home in October. In November following she was attacked with apoplexy in church and died in a few days. Just one year before she had had a pronounced chill, the cold stage of intermittent, while sitting in the same seat. In this case the glaucoma was several times a threatening symptom, and it is fair to assume that the therapeutic measures adopted for her relief were effective in warding it off.

The general therapeutic measures which have been suggested are fortunately also well calculated to relieve the intraocular conditions. As we all know, the iodine salts and the bromide of potassium or lithium and bichloride of mercury are markedly beneficial in treating diseases of the chorioid and retina of the nonhæmorrhagic as well as the hæmorrhagic form. The value of ergot in these purely local affections is also well recognized; but in addition to these general measures certain local means are unquestionably of great value. In the first place absolute rest of both eyes is of great importance, and to this end, where refraction errors exist they should be carefully corrected, so that even in moving about all strain upon the fellow as well as the involved eye is removed. Plane smoked glasses should be worn to protect from glare of light. Plane glasses are preferable for the reason that the coquilles are usually irregular concave cylinders, and thus cause much irritating strain. Systematic local depletion is important. A single leech either to the temple or over the mastoid on alternate days, preferably before retiring at night. The local free use of a boric-acid wash, to which a very little cocaine may be added, not more than half a grain to the ounce, used with an eye cup rather than a pipette, is a grateful application, and removes the conjunctival irritation so often present. Even in the hæmorrhagic stage of the disease I esteem weak solutions of the sulphate or salicylate of eserine, not more than one-tenth of a grain to the ounce, instilled twice or thrice daily, of much value. I have long held the opinion that eserine was valuable because of its stimulating action over the muscular coat of the vessels, and I am gratified to note that this view is also suggested by Laqueur. Warm and moist applications favor congestion and should be forbidden.

Period of confirmed glaucoma.—Unfortunately the most painstaking and well-directed treatment of hæmorrhagic retinitis does not prevent the onset of glaucoma, and we are driven to a choice in the majority of cases between a primary enucleation of the eye and certain operative procedures, performed not in the hope of

restoring vision, for this is already hopelessly lost, but in the hope of saving the eyeball. We can readily believe that if general and local therapeutic means employed during the hæmorrhagic stage have failed to ward off the attack, they will be of little avail, after the onset of glaucoma is well established. In fact the excruciating pain is rarely relieved except by surgical procedure. Strong solutions of eserine, frequently repeated, local bleeding, and hot applications to the ball sometimes give partial but only transient relief.

Stilling (Arch. Oph., Vol. 16, p. 445) recommends the use of chloral as having the property of reducing the tension of the ball, and De Schweinitz also recommends this drug for this purpose. The pain continuing, we are driven to surgical effort.

The result of operative measures for the preservation of either vision or the eyeball are extremely discouraging and, as has already been pointed out, in the great majority of cases the ball must be sacrificed to give permanent relief from pain. The gratifying results of iridectomy in ordinary glaucoma are not realized in this disease. Nevertheless, in case I it gave marked relief, which might have endured but for the unfortunate attack of cholera morbus. In the second eye of case II, although blindness was not averted, it nevertheless gave permanent relief from increased tension and pain, and the eyeball was preserved. The same was true of one case each, reported by Ayres and De Schweinitz. In a few other cases the ball was retained, presumably as the result of iridectomy. Notwithstanding this, the consensus of opinion is opposed to iridectomy. On this point, however, there is a diversity of opinion, and I can not entirely agree with the view of Bourgon that it should be vigorously prescribed. Paracentesis of the cornea in case I gave complete relief from pain, which lasted several days, and therefore commends itself as a simple measure for temporary relief until other and more radical means may be adopted. Sclerotomy at the rim of the anterior chamber seems on the whole to commend itself as superior to iridectomy, a fact to have been anticipated, having in mind the general vascular disease. After a careful study, should future responsibilities arise, I should first of all do sclerotomy or paracentesis of the vitreous chamber and, having by this means relieved the tension of the globe and possibly secured a deeper anterior chamber, perform either a free anterior sclerotomy or, if the iris were moderately healthy, a broad iridectomy.

DISCUSSION.

Dr. Chisolm. Our general experience fully sustains the opinion that hæmorrhagic glaucoma is the most destructive of eye troubles and least amenable to surgical or medical treatment. In my earlier career when I attempted to allay the pain by iridectomy I had the misfortune of inducing a rupture of retinal vessels and a destruction of the eye speedily by panophthalmitis. In such cases now shun operative procedure. I have, in the midst of the general fatality had one good result from iridectomy in hæmorrhagic glaucoma. A gentleman, aged 73, first consulted me in 1873. I found slight bending of vessels and a hæmorrhage near the disk. He was myopic. I gave him strychnine $\frac{1}{20}$ gr. three times a day, and used eserine 1 grain to 1 ounce morning and evening. From time to time I saw him. He did not live in Baltimore. The eserine kept the eye quiet, and the strychnine was a good tonic. He kept up this treatment for two years. In the meantime the hæmorrhage had quite disappeared and vision had not materially deteriorated. He had $\frac{15}{200}$, and could be improved by glasses. He was becoming restless under the daily use of the medication and requested operation. He had been all his life a bookworm and had posted himself about his disease. He knew all that the books contained about the value of iridectomy, which he desired me

to perform. The operation was satisfactory. In the course of time I adjusted glasses and lost sight of him. Three weeks since I received a letter from him with this statement: "I feel it my duty to state to you the result of your operation. The operated eye is now as serviceable as it was when you operated on it, but the one not operated on, which was then the best, is now totally useless."

Dr. WOLFE. I have listened with much pleasure to Dr. Risley's interesting paper. I was particularly pleased with the remarks referring to the etiology of hæmorrhagic glaucoma, as they remind us that not all eye troubles are to be traced to errors of refraction. A considerable number of hæmorrhagic as well as the other forms of glaucoma are caused by mental emotion. A widow who had suffered grief and anxiety in nursing her husband, a mother who has been mourning the loss of a child, a gentleman who has met with heavy losses in business; all mental distress may produce glaucoma in persons whose nervous and vascular systems predispose them to eye affections. The urinary secretions should be attended to; they generally indicate malnutrition and derangement of the organism. In addition to uric acid we sometimes find some traces of sugar. With regard to the question of operative interference I am guided by the physiognomy of the eye. With a moderate anterior chamber and the iris not quite atrophied I perform a large iridectomy, not with any sanguine hope of giving vision, but to save enucleation, which I very much dislike. I prefer in extreme cases the puncture of the sclerotic and allowing the escape of a very little of the vitreous. Of course a great deal depends upon the stage when the case comes before us.

Dr. HUBBELL, of Buffalo, N. Y. Dr. Risley's paper has been to me a very interesting one and his experience is another proof of the inefficiency of treatment to save vision and prevent suffering in hæmorrhagic glaucoma. He has again demonstrated that the prognosis is unfavorable and the only means of relief is enucleation. I have had two cases, both occurring in the advanced stages of the disease, and the radical treatment was at once resorted to. There appears to be little doubt as to the pathology of the disease, being a general arterio-sclerosis in which the vessels of the eye participate. The histological studies of Valude, of Paris, which I had the pleasure of presenting to the English-speaking profession in a translation published recently in the Ophthalmic Record, together with those of others, seem to establish this fact. Yet I ask why it is that hæmorrhagic glaucoma, as in Valude's cases, Dr. Risley's, my own, and those of others, is so frequently monolateral? The case which the president of our section has cited seems to me not to belong to the class under discussion. We must distinguish between hæmorrhagic and ordinary glaucoma, with accidental retinal hæmorrhages, and between hæmorrhagic glaucoma and hæmorrhagic retinitis, with possibly an incidental increase of tension. While we all have the highest regard for Dr. Chisolm's skill in diagnosis, yet is it not possible that his case was one of ordinary glaucoma, with retinal hæmorrhage, and not typical hæmorrhagic glaucoma at all? If it was not hæmorrhagic glaucoma proper, then it does not cast any doubt upon the position which I hold, viz., that this disease is fatal to vision and that palliative and tentative treatment is of no avail.

Dr. RISLEY, in closing the discussion, said he had been much interested in the case reported by Dr. Chisolm. If we were to accept it as a case of hæmorrhagic glaucoma its history offers an excellent demonstration of the fact quoted in this paper from Thoma that in the beginning of the arterio-sclerosis hæmorrhages were more likely to occur; that as time goes on the vessel walls were strengthened by the connective tissue produced in the retina. The operation was performed long after the hæmorrhages were first noted, and during this time this strengthening of the blood vessels may have taken place, thus affording an admirable illustration of nature's conservatism. Certainly the hæmorrhage had ceased at the time of the operation. Since, however, when first seen the case was regarded as one of glau-

coma with hæmorrhages, and not apoplectic retinitis, he feared it could not be included in the group under discussion. Much as he would welcome even one case of cure of hæmorrhagic glaucoma, certainly cured by any means, he thought that Dr. Chisolm's case must be placed in a group with primary glaucoma. He was glad to hear Dr. Wolfe's remarks regarding the important effect of the emotions, grief and disappointment particularly, in the etiology of glaucoma. This was especially demonstrated in the cases reported. He felt, however, that this result was produced by the disturbance of nutrition under the depressing influence of grief. All were familiar with attacks of jaundice and digestive derangements consequent upon these depressing influences. In a word, the blood stream became loaded with poisonous products, which in turn set up or aggravate the intraocular conditions characteristic of glaucoma, especially in eyes where glaucoma was imminent.

In reply to Dr. Hubbell he would say that the disease was by no means a monocular disease. In the 20 cases collected in the paper, in 4 of them, or 20 per cent, the disease was binocular.

A COMPARISON OF THE EYES OF WHITE AND COLORED PUPILS IN THE PUBLIC SCHOOLS OF WASHINGTON, D. C.

By E. OLIVER BELT, M. D., of Washington, D. C.

By numerous examinations made in the schools of this country and of Europe it has been found that comparatively few children are nearsighted when they first begin school, but at the end of school life a large percentage have this defect. According to a paper on the subject by Dr. S. D. Risley, of Philadelphia, in an examination by Drs. Loring and Derby of the eyes of 1,133 school children in the city of New York, 3.55 per cent were found to be myopic at 7 years of age, while at 20 years 26.79 per cent were nearsighted. In St. Petersburg, Prof. Erismann found, in 4,538 pupils, 13.6 per cent of myopia in the primary and 42.8 per cent in the higher classes. In Germany the rise was from 11.1 per cent to 52.1 per cent. The fact of this increase of nearsightedness during school life being established, the important point for the physician to consider is its cause and its prevention. It is also found that hypermetropic eyes are most common in the primary grades, and there is a marked decrease in this defect by the end of school life, while the percentage of eyes with normal refraction remains about the same throughout the different grades.

Now, are the eyes which become nearsighted, those which were normal, or are the farsighted eyes unhealthy ones, and do they change their refraction to normal and then continue to change until they become myopic? These are questions which should be determined if we wish to prevent these increasing defects. That heredity and older civilization have much to do with the frequency of myopia would seem to be indicated from comparisons made between pupils in Europe and this country. And I have thought a comparison between the eyes of white and colored children would throw additional light upon this point. Whether there is a tendency for hypermetropic eyes to become myopic could only be determined by examination of the same pupils for a series of years through different grades. With these objects in view I applied to Prof. W. B. Powell, superintendent of the public schools, Washington, D. C., for the purpose of making examinations among children in the public schools. Prof. Powell at once took a deep interest in the investigation, and gave me permission to examine as many pupils as I desired in both white and colored schools.

This report is a summary of results found in the Grant school, which is composed of white pupils, and in the Mott school, which is composed of colored pupils. Mr. S. M. Ryder, principal of the Grant school, and Dr. W. B. Evans, of the Mott

school, took an active interest in the matter and gave me valuable assistance, especially in securing consent of the parents for the examination.

Four hundred and twenty pupils were examined, 210 from each school, 15 boys and 15 girls from each grade except the first. Their ages ranged from 6 to 17 years. All defects were noted, cases of myopic astigmatism were placed under the heading of myopia, and hypermetropic astigmatism under hypermetropia. The refraction was tested with lenses and by retinoscopy. There was only 1 case of color-blindness in each school, less than 0.005 per cent, and each case was among the boys.

By most authors the usual percentage of color-blindness is from 0.03 to 0.05 per cent among males, and less than 0.01 per cent among females. I am informed by Prof. Powell that the pupils in the public schools here are taught the colors, so this lessened the possibility of color ignorance being mistaken for color-blindness.

There were only 4 cases of amblyopia, and all were among white girls. There were 10 diseased eyes in the white school and 4 in the colored school, aside from errors of refraction and cases of conus. There were 5 cases of choroidal atrophy in the white and 1 in the colored. There were 4 cases of corneal opacity in the white and 2 in the colored, and there was 1 cataract in each. There was 6 cases of strabismus in each. In the white 3 cases were internal and 3 external; in the colored 1 case was internal and 5 external. Conus or pigment about the disk was found in 15 per cent of the cases of emmetropia in the white, and 13 per cent in the colored; in 21 per cent of the cases of hypermetropia in the white, and 18 per cent in the colored; and in 16 per cent in the cases of myopia in the white, and 15 per cent in the colored. In the total number of cases of conus there was an increase of only 0.02$\frac{2}{9}$ per cent from the three lower to the three higher grades in the white, and of 0.03$\frac{8}{9}$ per cent in the colored. Conus is thought by many to be an indication of error or change of refraction, and though there can be no question about its meaning in errors of high degree, it seems to me very doubtful whether slight pigmentation about the disk is always pathological. Normal acuteness of vision was found in 80 per cent of the white boys and 94 per cent of the colored boys, and in 68 per cent of the white girls and in 86 per cent of the colored girls.

The following was found to be the average refraction:

	Emmetropic.		Hypermetropic.		Myopic.	
	White.	Colored.	White.	Colored.	White.	Colored.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Boys	0.71	0.80	0.16	0.15	0.12	0.04
Girls	.49	.73	.31	.18	.19	.08
Total	.60	.76	.23	.16	.16	.06

The number of pupils examined was too small to get a correct idea of the decrease of hypermetropia and the increase of myopia from a comparison of the lowest with the highest grade. But by comparing the three lower with the three higher grades we can form an estimate of the changes during school life.

The averages were as follows:

	Emmetropic.		Hypermetropic.		Myopic.	
	White.	Colored.	White.	Colored.	White.	Colored.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Three higher grades	0.60	0.71	0.17	0.16	0.23	0.12
Three lower grades	.59	.83	.31	.16	.10	.01
Increase or decrease	+.01	—.12	—.14	—.00	+.13	—.11

This shows that the percentage of eyes with normal refraction remained about the same in the white and decreased 0.11 per cent in the colored schools. While there was a decrease in hypermetropic eyes from 0.31 to 0.17 per cent in the white, the colored remained about the same, and there was an increase of myopic eyes from 0.10 to 0.23 per cent in the white, and from 0.01 to 0.12 per cent in the colored. Errors of 0.05 D. or less were not noted, except in cases of astigmatism, from a belief that it is often impossible to determine errors that slight without a mydriatic, hence the percentage of hypermetropia is not as high as found by some observers. The refraction found by me, however, corresponds closely with the average found by different observers in 160,000 eyes examined, which was as follows: Emmetropic, 58.8 per cent; hypermetropic, 21.9 per cent; myopic, 19.5 per cent. These figures are from a paper by Dr. B. Alex. Randall, of Philadelphia, to whom I am indebted for some valuable suggestions in reference to the investigation. In the following table I give the changes in refraction from the beginning to the close of school life among pupils in several cities:

Examined by—	Emmetropic.			Hypermetropic.			Myopic.		
	Beginning.	Close.	Increase or decrease.	Beginning.	Close.	Increase or decrease.	Beginning.	Close.	Increase or decrease.
Loring and Derby, New York	0.86	0.61	—0.25	0.09	0.12	+0.03	0.03	0.26	+0.23
Prout and Mathiewson, Brooklyn	.63	.60	— .03	.26	.15	— .09	.09	.23	+ .14
Risley, Philadelphia	.07	.12	+ .05	.88	.66	— .22	.04	.19	+ .15
Belt, Washington, white	.59	.60	+ .01	.31	.17	— .14	.10	.23	+ 13
Belt, Washington, colored	.83	.71	— .12	.166	.160	— .006	.01	.12	+ .11

The percentage of hypermetropia of 1 D. and over was 0.078 in the white, and 0.066 in the colored; and of myopia was 0.026 in the white, and 0.023 in the colored, while the astigmatism of all degrees was 0.25 per cent in the white and only 0.10 per cent in the colored. These statistics seem to indicate that hypermetropia and myopia of high degrees are nearly as common in one race as in the other, and may be due to malformation of the eyeball, independent of race or civilization; but that slight error, and especially astigmatism, are more commonly the result of abuse of the eyes, as found in a higher civilization.

Refraction error of 1 D. and above.

	Hypermetropia.		Myopia.		Astigmatism of all degrees.	
	White.	Colored.	White.	Colored.	White.	Colored.
Male ... per cent	11.052	13.061	1.004	3.014	47.223	11.052
Female ... do	22.104	15.071	10.047	7.032	58.276	31.147
Total ... do	33.078	28.066	11.026	10.023	105.250	42.100
Three higher grades	8	17	6	8	64	34
Three lower grades	21	4	2	2	30	4
Increase or decrease	—13	+13	+4	+6	+34	+30

CONCLUSIONS.

First, that children often have defective eyes without being aware of it, and are loth to complain of their troubles, as shown from the fact that although 40 per cent had defects which cause more or less discomfort, only 0.15 per cent complained of headache or of their eyes becoming tired or painful upon use. These

children, however, frequently give evidence of trouble by not advancing as rapidly in their studies as others of their age and too frequently are thought to be stupid when in fact their eyes are at fault. This is well illustrated in the second grade, in which most of the pupils are 7 or 8 years of age; there were some, however, still in the second grade who were 10 and 11 years of age, 80 per cent of whom had defective eyes, which was evidently the cause of their backwardness.

Second, the increase of nearsightedness among Washington school children is less than in most American cities, probably because their physical condition is better when they begin school. There is less poverty here. A smaller number live in overcrowded tenement houses, and their hygienic surroundings are generally better. The school buildings are well lighted and ventilated and the seats are arranged so they will not face the light. In some, though, the blackboards are placed between the windows, which is not to be commended. I am informed by Prof. Powell that close application for any length of time is not required of children in the lower grades, much of their teaching at this period being by object lessons. This is a most important point, for at this age the eyes are most easily injured. I think authorities agree with Dr. Risley, who says "the probability of harm resulting from the school life diminishes with every added year of age, in all states of refraction;" however, the marked increase of myopia between the ages of 14 and 16 years would indicate that the time of puberty is a critical one for the eyes.

Third, the few cases of abnormal eyes found among the colored pupils, as compared with the white, indicate the influence of the more advanced civilization in the causation of defective eyes. Especially is this so of astigmatism, which was found in 0.25 per cent of the white and in only 0.10 per cent of the colored pupils. Heredity also has much to do with it. Myopes should not marry myopes, and parents with eye trouble should especially be careful to see that their children's eyes have proper attention in order that they may avoid the development of the same defects.

Fourth, that hypermetropic eyes are unhealthy ones and tend to become myopic after passing through the stage of emmetropia would seem to be indicated by the facts that the decrease in hypermetropic eyes in the white school, which was 0.14 per cent, corresponds closely with the increase of myopia, which was 0.13 per cent, and the greater the percentage of hypermetropia at the beginning, the more myopia at the close; e. g., in the white school there was 0.31 per cent of H. at the beginning and 0.23 per cent of M. at the close, while in the colored school there was only 0.16 per cent of H. at the beginning and only 0.12 per cent of M. at the close. These facts being established it follows that correction of hypermetropia at an early age would probably prevent the development of many cases of myopia during school life.

Grades examined.	Eyes.	Average age.	Asthenopia.	Color blind.	Amblyopia.	Diseased.	Conus or pigment about disk.	20/20 V.	Em.		H. gl.	H. ret.	M. gl.	M. ret.	H. astig.	M. astig.	Em.		H.		M.	
									No.	Per ct.							No.	Per ct.	No.	Per ct.	No.	Per ct.
WHITE.																						
Eighth grade:																						
Males	30	15	14	2	.....	2	10	.....	23	0.76⅔	1	4	.....	2	3	2	23	0.76⅔	5	0.16⅔	2	0.06⅔
Females	30	14⅔	10	.....	.....	1	3	.....	14	0.46⅔	.....	8	6	6	10	8	14	0.46⅔	8	0.26⅔	8	0.26⅔
Total	60	14 7/10	24	2	.....	3	13	.....	37	0.61⅔	1	12	6	8	13	10	37	0.61⅔	13	0.21⅔	10	0.16⅔
Seventh grade:																						
Males	30	14½	6	.....	.....	.....	4	.....	20	0.66⅔	.....	.....	.....	8	4	6	20	0.66⅔	.....	.....	10	0.33⅓
Females	30	13⅔	6	.....	.....	.....	2	.....	6	0.20	.....	12	.....	8	2	15	6	0.20	12	0.40	12	0.40
Total	60	13⅞	12	.....	.....	.....	6	.....	26	0.43⅓	.....	12	.....	16	6	21	26	0.43⅓	12	0.20	22	0.36⅔
Sixth grade:																						
Males	30	13	7	.....	.....	.....	5	.....	23	0.76⅔	.....	.....	.....	2	5	5	23	0.76⅔	3	0.10	4	0.13⅓
Females	30	12⅔	7	.....	2	.....	5	.....	22	0.73⅓	.....	4	.....	4	2	2	22	0.73⅓	4	0.13⅓	4	0.13⅓
Total	60	12 2/7	14	.....	2	.....	10	.....	45	0.75	.....	4	.....	6	7	7	45	0.75	7	0.11⅔	8	0.13⅓
Fifth grade:																						
Males	30	11⅔	2	.....	.....	.....	7	.....	22	0.73⅓	2	6	1	.....	.....	6	22	0.73⅓	6	0.20	2	0.06⅔
Females	30	12	3	.....	1	2	11	.....	17	0.56⅔	2	5	2	3	.....	5	17	0.56⅔	5	0.16⅔	8	0.26⅔
Total	60	12	5	.....	1	2	18	.....	39	0.65	4	11	3	3	.....	11	39	0.65	11	0.18⅓	10	0.16⅔
Fourth grade:																						
Males	30	10½	1	.....	.....	.....	6	.....	22	0.73⅓	.....	3	.....	.....	1	8	22	0.73⅓	4	0.13⅓	4	0.13⅓
Females	30	10½	3	.....	1	.....	2	.....	22	0.73⅓	2	7	.....	1	2	2	22	0.73⅓	7	0.23⅓	1	0.03⅓
Total	60	10 7/10	4	.....	1	.....	8	.....	44	0.73⅓	2	10	.....	1	3	10	44	0.73⅓	11	0.18⅓	5	0.08⅓
Third grade:																						
Males	30	9½	.....	.....	.....	.....	2	.....	18	0.60	3	9	.....	2	.....	4	18	0.60	10	0.33⅓	2	0.06⅔
Females	30	9	7	.....	.....	3	7	.....	13	0.43⅓	2	14	.....	2	7	.....	13	0.43⅓	15	0.50	2	0.06⅔
Total	60	9 1/10	7	.....	.....	3	9	.....	31	0.51⅔	5	23	.....	4	7	4	31	0.51⅔	25	0.41⅔	4	0.06⅔
Second grade:																						
Males	30	8⅔	1	.....	.....	.....	4	.....	21	0.70	.....	6	.....	2	1	2	21	0.70	6	0.20	3	0.10
Females	30	7⅔	1	.....	.....	2	4	.....	10	0.33⅓	.....	14	2	6	1	2	10	0.33⅓	14	0.46⅔	6	0.20
Total	60	8 1/10	2	.....	.....	2	8	.....	31	0.51⅔	.....	20	2	8	2	4	21	0.51⅓	20	0.33⅓	9	0.15

Males:																						
Total	210	8–15	31	2	.....	2	38	.....	149	6	28	7	16	14	33	149	34	27
Per cent	.....	.....	0.14	0.009	.....	0.009	0.18	.....	0.71	0.03	0.13	0.004	0.07$\frac{9}{7}$	0.06$\frac{2}{3}$	0.15$\frac{2}{7}$	0.71	0.16	0.15
Females:																		
Total	210	7–14	37	.....	4	8	34	.....	104	6	64	10	30	24	34	104	65	41
Per cent	.....	.....	0.17	.....	0.02	0.04	0.16	.....	0.49	0.03	0.30	0.04	0.14	0.11	0.16	0.49	0.31	0.19
Grand total	420	7–15	68	2	4	10	72	.....	253	12	92	11	46	38	67	253	99	68
Per cent	.....	.....	0.16$\frac{4}{21}$	0.004	0.01	0.02	0.17$\frac{1}{7}$	.....	0.60$\frac{5}{21}$	0.02$\frac{4}{7}$	0.22	0.02$\frac{13}{21}$	0.11	0.09	0.16	0.60$\frac{5}{21}$	0.23$\frac{4}{7}$	0.16$\frac{4}{21}$
COLORED.																		
Eighth grade:																		
Males	30	15$\frac{1}{2}$	.....	2	.....	2	3	27	21	0.700	2	6	1	3	.....	3	21	0.700	6	0.200	3	0.100
Females	30	15$\frac{3}{8}$	3	.....	.....	.....	3	24	20	0.666	2	4	.....	2	2	11	20	0.666	4	0.133	6	0.200
Total	60	15$\frac{1}{2}$	3	2	.....	2	6	51	41	0.683	4	10	1	5	2	14	41	0.683	10	0.166	9	0.150
Seventh grade:																		
Males	30	14$\frac{1}{2}$	1	.....	.....	.....	3	26	27	0.900	.....	.....	.....	8	1	4	27	0.900	1	0.033	2	0.066
Females	30	14$\frac{1}{2}$	2	.....	.....	.....	12	25	18	0.600	4	6	3	6	2	7	18	0.600	6	0.200	6	0.200
Total	60	14$\frac{3}{8}$	3	.....	.....	.....	15	51	45	0.750	4	6	3	14	3	11	45	0.750	7	0.116	8	0.133
Sixth grade:																		
Males	30	14	.....	.....	.....	.....	2	30	23	0.766	2	6	.....	6	.....	1	23	0.766	6	0.200	1	0.033
Females	30	14	2	.....	.....	.....	4	26	20	0.666	4	6	4	4	.....	3	20	0.666	6	0.200	4	0.133
Total	60	14	2	.....	.....	.....	6	56	43	0.716	6	12	4	10	.....	4	43	0.716	12	0.200	5	0.086
Fifth grade:																		
Males	30	13$\frac{1}{2}$	4	.....	.....	.....	8	29	25	0.833	2	4	1	3	.....	.....	25	0.833	4	0.133	1	0.033
Females	30	13$\frac{1}{2}$	5	.....	.....	.....	6	29	21	0.700	2	8	1	2	2	1	21	0.700	8	0.266	1	0.033
Total	60	13$\frac{1}{2}$	9	.....	.....	.....	14	58	46	0.766	4	12	2	5	2	1	46	0.766	12	0.200	2	0.033
Fourth grade:																		
Males	30	12	.....	.....	.....	.....	.....	30	27	0.900	.....	2	.....	.....	1	.....	27	0.900	3	0.100	0	0.000
Females	30	12	3	.....	.....	.....	8	22	23	0.766	3	7	.....	3	2	.....	23	0.766	7	0.233	0	0.000
Total	60	12	3	.....	.....	.....	8	52	50	0.866	3	9	.....	3	3	.....	50	0.866	10	0.166	0	0.000
Third grade:																		
Males	30	11	.....	.....	.....	.....	8	30	26	0.866	.....	4	.....	.....	.....	.....	26	0.866	4	0.133	0	0.000
Females	30	11$\frac{1}{2}$	1	.....	.....	.....	.....	30	28	0.933	.....	2	.....	.....	.....	.....	28	0.933	2	0.066	0	0.000
Total	60	11$\frac{1}{2}$	1	.....	.....	.....	8	60	54	0.900	.....	6	.....	.....	.....	.....	54	0.900	6	0.100	0	0.000

Grades examined.	Eyes.	Average age.	Asthenopia.	Color blind.	Amblyopia.	Diseased.	Conus or pigment about disk.	20/20 V.	Em.		H. gl.	H. ret.	M. gl.	M. ret.	H. astig.	M. astig.	Em.		H.		M.	
COLORED—cont'd.																						
									No.	*Per ct.*							*No.*	*Per ct.*	*No.*	*Per ct.*	*No.*	*Per ct.*
Second grade:																						
Males	30	9 4/5	------	------	------	------	2	26	20	0.666	------	8	2	2	1	------	20	0.666	8	0.266	2	0.066
Females	30	9 3/5	------	------	------	------	2	25	24	0.800	------	6	------	2	------	------	24	0.800	6	0.200	0	0.000
Total	60	9 7/10	------	------	------	------	4	51	44	0.733	------	14	2	4	1	------	44	0.733	14	0.233	2	0.033
Males:																						
Total	210	------	5	2	------	2	26	198	169	------	6	30	4	22	3	8	169	------	32	------	9	------
Per cent	------	------	0.002	0.009	------	0.009	0.12	0.94	----	0.804	0.02	0.14	0.02	0.10	0.01	0.04	----	0.804	----	0.152	----	0.042
Females:																						
Total	210	------	16	0	------	0	35	181	154	------	15	39	8	19	8	23	154	------	39	------	17	------
Per cent	------	------	0.007	0.000	------	0.000	0.16	0.86	----	0.733	0.07	0.19	0.04	0.09	0.04	0.10	----	0.733	----	0.185	----	0.080
Grand total	420	------	21	2	------	2	61	379	323	------	21	69	12	41	11	21	323	------	71	------	26	------
Per cent	------	------	0.05	0.004	------	0.004	0.14	0.90	----	0.769	0.05	0.16	0.03	0.09	0.03	0.05	----	0.769	----	0.169	----	0.063

FURTHER STUDIES OF THE CYCLOPLEGIC VALUE OF HOMATROPINE AND COCAINE DISKS, AS ATROPINE, DUBOISINE, AND HYOSCINE SUBSTITUTES.

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Nearly three years ago, in an article contributed to the American Journal of Ophthalmology, I gave the results of some experiments I had made with mixtures of homatropine and cocaine, and with solutions of atropine and duboisine, for the purpose of comparing their relative merits as cycloplegics. The conclusions I then arrived at were these:

(1) In the shape of watery solutions probably less than 10 per cent of the dissolved alkaloid becomes absorbed in such a way as to affect the eye, the remaining 90 per cent being carried off into the nasal duct or flowing over the cheek with the tears.

(2) Mixtures prepared with vaseline, sanitas jelly, lanolin, and similar menstrua, or, as in Lang and Barrett's* experiments, castor oil, are much longer retained in the conjunctival sack. The drugs thus longer kept in contact with the ocular and palpebral surfaces undergo, as Green suggests, a much more extensive absorption and produce a still more pronounced effect.

(3) They are absorbed by the blood vessels and other absorbents of the cornea and conjunctiva, and not by those of the nose and throat. But such oily and greasy mixtures have this serious drawback: They leave a thin film upon the corneal surface which interferes with the examination of the eye, especially when one wishes to determine the refractive condition.

(4) The form of gelatin lamellæ or disks appear to be the most useful one in which to apply agents to the eye for the purpose of securing their fullest mydriatic and cycloplegic action. These undergo a slow, regular, and complete absorption when put into the conjunctival sack.

(5) The addition of cocaine to almost all the alkaloids used in ophthalmic practice undoubtedly increases their peculiar effects. (See also the reports of Malakoff and the experiments of Lang and Barrett beforementioned.)

(6) From the foregoing results, and after much experimentation on the subject, I concluded that the most decided cycloplegic effects of homatropine are obtainable from its employment in the gelatin disk form, associated with cocaine. In its most convenient and stable shape these disks can not be made to hold more than gr. $\frac{1}{25}$ of these alkaloids, hence I was necessarily restricted to the use of gr. $\frac{1}{50}$ each Merck's homatropine and cocaine.

Since the publication of my original paper I have not lost sight of the purpose I originally had in view, viz, the attempt to find some cycloplegic less objectionable than atropine for the measuring of refractive errors. I happen to be a firm believer in the doctrine that it is necessary to know the absolute refractive condition before one can intelligently prescribe glasses, and I further believe that it is requisite to paralyze the accommodation as the best means of obtaining the information in the majority of cases under, and in some cases over, 40 years of age. For the past year I have been engaged in this line with the gelatin disks aforesaid, with disks containing gr. $\frac{1}{25}$ of homatropine alone, and with various solutions in water tropacocaine, homatropine plus cocaine, duboisine sulphate, atropine sulphate, hyoscine hydrobromate, and hyoscyamine sulphate. Without troubling you with details, I may say briefly that for the determination of the refractive condition, and with the idea of making the conditions of the comparative test

*Lang and Barrett: The Action of Myotics and Mydriatics. Oph. Hos. Reports, Vol. XI, 130 and 219.

as constant as possible, I chose those patients in whom I could employ a number of agents at proper intervals, and whose refractive state would be most likely to afford reliable tests. These were put under the influence of the particular cycloplegic and their refractive state determined by retinoscopy. Every case was carefully worked out by my assistant, Dr. T. A. Woodruff, who is an expert skioscopist. Sometimes one agent was used first, sometimes another, but in every instance the effect of the previous cycloplegic was allowed to pass off before the second was employed. Using all possible care to avoid sources of error, the refraction of 34 selected eyes, furnishing 68 principal meridia, was thus determined. The results I have here drawn up in chart form.

Number.	Atropine.	Hyoscine.	H. and C. discs.	Number.	Atropine.	Hyoscine.	H. and C. discs
1	+3.	+3.25	+3.	35	+5.	+4.50	+5.
2	+1.75	+1.75	+1.75	36	+6.50	+6.50	+6.50
3	+2.75	+2.50	+2.50	37	+5.	+5.	+5.
4	+1.50	+1.50	+1.50	38	+6.	+5.50	+6.
5	+0.75	+0.50	+0.50	39	+5.		+4.50
6	+4	+4.25	+4.	40	+8.		+8.
7	+2.25	+2.25	+2.	41	+4.50		+4.
8	+3.25	+3.50	+3.25	42	+6.		+6.
9	+1.25	+1.75	+1.50	43	+8.		+8.
10	+2.50	+2.75	+2.75	44	+9.		+9.
11	+1.50	+1.50	+1.50	45	+10.		+9.50
12	+2.75	+3.	+2.75	46	+11.		+10.50
13	+2.75		+2.50	47	+1.25		+1.25
14	+2.75		+2.50	48	+1.50		+1.50
15	+2.75		+2.50	49	+2.		+1.75
16	+2.75		+3.	50	+2.25		+2.25
17	+5.	+5.50	+5.	51	+2.25		+2.25
18	+5.	+6.	+5.50	52	+2.25		+2.25
19	+6.25	+5.50	+6.	53	+7.		+7.
20	+7.	+7.	+6.50	54	+11.		+11.
21	+1.75		+1.25	55	+6.50		+6.50
22	+1.25		+1.25	56	+10.		+9.50
23	+1.50		+1.25	57	+3.25		+3.
24	+1.75		+1.50	58	+3.		+3.
25	+3.75	+3.75	+3.75	59	+3.25		+3.25
26	+5.50	+5.	+5.50	60	+3.		+3.
27	+2.50	+2.75	+2.50	61	+1.50		+1.50
28	+3.50	+3.25	+3.50	62	+3.50		+3.50
29	+6.50	+7.	+6.25	63	+3.75		+3.75
30	+6.50	+7.	+6.50	64	+2.		+2.
31	+2.25		+2.	65	−1.	−1.	−1.
32	+2.		+1.50	66	+1.25	+1.25	+0.50
33	+1.50		+1.50	67	+4.50	+4.	+4.50
34	+1.50		+1.50	68	+5.50	+5.50	+3.75

In these observations (166 in all) 2 drops of 1 per cent solution of atropine sulphate were dropped in each eye 3 times daily, after meals, for 2 days, and the examination made in from 1 to 3 hours after the last instillation. Of the hyoscine and hyoscyamine 2 drops of a 4-grain solution were instilled into each eye 3 times at intervals of 20 minutes, and the examination made in from 1 to 2 hours after the last dose. The disks were employed as hereafter described. Every precaution was taken to prevent poisoning by the hyoscine and the disks were used for the examination of the same merida in 30 instances. In 16 of these the refraction was exactly the same, or the highest differed from the lowest not more than 0.25 D. In 10 instances the difference was 0.50 D. In only 2 instances out of the 30 was there a greater difference than 0.50 D., a case to be afterwards referred to. In these 30 cases atropine showed the highest refraction or was one of the highest in 19 instances: hyoscine in 22 instances, and homatropine and cocaine disks in 15 instances. Coming now to the tests of atropine and H. & C. disks we found that they were the same, or did not vary more than 0.25 D. in 58 out of 68 meridia. Of the remaining 10 the result varied 0.50 D. in 8 cases, and in 2 instances there was a radical difference, to be again referred to. Speaking generally, atropine showed a higher refractive condition than the disk in 21 out of the 68 cases, while the disks showed an increased refraction over atropia in 4 instances. In a single instance of mixed astigmatism, before referred to, did the refraction of 2 principal meridia

amount to more than 0.50 D., viz, 0.75 D. and 1.75 D. greater in the case of atropine than that shown by the disks. In this case the disks were first used. That this may happen in a second trial of any cycloplegic, in relieving a spasm of the accommodation, is well known. I have recently had a case which well illustrated this fact, where a second trial with atropine showed a much greater difference. A boy, aged 16, with marked astigmatism in each eye was atropinized in the usual way with 1 per cent solution, and the skioscopy and result was 2.75 D., 3.25 D., 2.50 D., 3.25 D. A week later he was found to have with full correction nearly in either eye. My suspicion being aroused by this early acceptance of his glasses I again atropinized his eyes and the result was +4 D. and +4.75 D., +4.50 D. and +5.25 D., i. e., an advance of between 1.25 D. and 2.00 D. in the 4 meridia. Ten days afterwards he obtained V.= $\frac{6}{6}$ — in either eye. A month afterwards his V. in each eye was $\frac{6}{6}$ + with all symptoms relieved.

As a result of these and other experiments I have reached the following conclusions, some of which are modifications of the propositions contained in my first article:

(1) If two gelatine disks containing gr. $\frac{1}{50}$ each of homatropine and cocaine be placed in the conjunctival sac at an interval of 20 minutes, the eye being all the while kept closed, the ciliary muscle will in most instances be found to be fully paralyzed in from 70 to 100 minutes after the introduction of the first disk.

(2) In persons under 25 years old, or whenever ciliary spasm is suspected, the best results are obtained by the use in another 20 minutes of a third disk or one containing gr. $\frac{1}{25}$ of homatropine alone, the examination in that case being best made between 90 and 120 minutes after using the disk. The first two disks containing cocaine are sufficient to furnish the chief advantage which, in my opinion, resides in that alkaloid, viz, of increasing the absorbing powers of the cornea for agents combined with it, while the increased dose of homatropine produces a more thorough relaxation of the ciliary muscles. An eserine disk (gr. $\frac{1}{1000}$) inserted the following morning will enable the patient to do near work within an hour or two. (3) The disk should be inserted in the eye on the tip of a damp camel's hair brush and should always be applied to the ocular conjunctiva at its inferior and outer surface, the patient looking up and in while the lower lid is drawn down. Any adherent or sticky gelatine may be easily wiped off the palpebral edges with a damp cloth or a piece of wet absorbent cotton.

In my preference for these disks over any solution of atropine I wish to state that I do so only on the grounds of the quicker and more evanescent cycloplegic action of the former. I always use atropine whenever I possibly can, and particularly if in my judgment the patient would be benefited by ciliary rest, as many of our cases are. But for the business man, the clerk, the bookkeeper, the lawyer, the doctor, the school-teacher, *et hoc genus omne*, ten days of ciliary or any other kind of rest is usually impossible. It is with them either an examination for glasses of the optician and jewelry store order or a transient cycloplegia.

In the list of dangerous cycloplegics I would place duboisine, hyoscine, and hyoscyamine. They are all, especially the last two, much prompter and more fiercely active cycloplegics than atropine or these disks. If hyoscine and hyoscyamine are used in solution and in doses strong enough to insure ciliary paresis, i. e., in disks somewhat less than atropine and duboisine, they are certain to produce toxic symptoms more or less pronounced in about one-quarter of the cases. If used at all they should be instilled in the oculist's office, and in my experiments I found this to be the only safe plan to pursue. If this be done, the refractive condition can be readily determined in one day, the ciliary paresis passing off in from 72 to 96 hours. Upon their cycloplegic action single disks of eserine have little or no permanent effect. Tropacocaine has, so far as my experiments went, no cycloplegic advantages over cocaine, while its mydriatic action seemed to me to be less than that of cocaine.

THE NECESSITY FOR COMPLETE SUSPENSION OF ACCOMMODATION BY MYDRIATICS IN THE ADJUSTMENT OF GLASSES.

By G. C. SAVAGE, M. D.,

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If the accommodation could be suspended instantaneously and then, after the work of refraction has been accomplished, could it be as speedily restored to the normal, who and where is the oculist who would not exercise such magical power in all his cases of refraction? If the exercise of this supposed magical power would be justifiable, then there must be some strong reasons for using the means, really at our command, for putting at rest the ciliary muscle when a focal error, whatever may be its nature, is to be corrected. It is the object of this paper to give the reasons that not only justify but actually demand the use of the mydriatic in refractive work. In presenting the numerous reasons for the use of the mydriatic in the work of refraction all the reasons against its use will be met. While in some cases glasses may be prescribed simply to sharpen vision, it must be confessed that the greater number of cases coming under the observation of the oculist are persons who suffer because of strain. This leads us to inquire, what is eye-strain? A clear understanding of what the answer to this question should be will go far toward settling the question of the proper line of practice intended for its relief.

None will controvert the statement that eye strain is muscle strain, and that the muscles concerned in the visual act are; first, those regulating the quantity of light admitted into the eye and the direction of its rays, these are the two sets of fibers in the iris, and the ciliary muscle; second, the extrinsic muscles, the recti and the obliqui, which are concerned in directing the visual axes and in keeping the naturally vertical meridians of the corneæ so related that images may fall on corresponding parts of the two retinæ. Muscular action is not muscle strain, unless the action is either too prolonged or too great for the inherent power of the muscle. Some, by their teaching, would show that only the ciliary muscle is susceptible of strain, and that ciliary strain alone is capable of bringing into existence that long train of nervous phenomena with which the oculist and, of late years, the neurologist are so well acquainted There are others who are accused of believing and teaching that the extrinsic muscles are alone susceptible of that fatigue which brings discomfort, in varied forms, to our patients. There are not a few, however, whose practice is governed by the sounder doctrine that both the intrinsic and extrinsic eye muscles may be put to the necessity of doing more work than their strength will bear, and that the consequent strain, whether in the one set or in the other, or in both at the same time, will develop headache, vertigo, confusion of thought and a host of other phenomena. While glasses prescribed for the correction of focal errors were once thought capable of curing all symptoms dependent on eye strain, the time is now when no such claim can be sustained. Lenses that give a perfect correction of existing focal errors may, in some instances, augment rather than allay the suffering due to eye strain. Such patients would be better without lenses until the chief cause of suffering, in the individual case, has been found and, by the proper treatment, cured. But I am not one to cry out against the prescribing of glasses. My wearing lenses is sufficient evidence of my regard for and my appreciation of them. Properly determined, scientifically prescribed, and correctly worn, they do only good. But in prescribing glasses we must take into consideration both the focal error and the muscular adjustment, particularly the adjustment of the internal and external recti. Since glasses can do more than relieve ciliary strain; they can, if properly selected, relieve strain of the internal and external recti independent of pris-

matic effect;* also strain of the oblique muscles in cases of oblique astigmatism; they should be scientifically prescribed, after a most painstaking study of the focal error and the muscular adjustment.

For the present, fixing our attention on focal errors, we find that there are these: myopia, hypermetropia, and the several kinds of astigmatism. In emmetropic eyes there is no strain, in the proper sense, when used in moderation. In simple myopia of 3 D. or more the ciliary muscle is never called into action and, therefore, can never be strained. If such eyes give annoyance, other than dimness of distant vision, the cause must be sought, and will be found in the relationship of the extrinsic muscles. In simple hypermetropia the ciliary muscle, during waking hours, is ever acting until quieted by age. Any action of the ciliary muscle for sharpening distant vision is strain, and in such eyes overaction (strain) is necessary in order to good near vision. In some of these cases the ciliary muscle is hyperdeveloped, the center controlling it has an abundant supply of nerve force and there are no symptoms resulting from the strain. Other hypermetropes are not so fortunately constituted, and the ciliary strain, caused by the refractive error, is felt in some form or other.

In astigmatism, of whatever kind, with the principal meridians in the vertical and horizontal, or if oblique the obliquity is in the same direction and at the same angle in the two eyes, the astigmatic refraction also being equal in the two eyes, there is ciliary strain directed against this refractive error. As to the character of the effort made by the ciliary muscle there is some difference of opinion. Whatever may be the nature of this strain it is capable of correcting wholly only the lower degrees of astigmatism, and only a small part of the higher degrees of this error; but that the effort is being continually made for distant and near vision, in cases of hypermetropic and mixed astigmatism, also in myopic astigmatism, when near vision is attempted, there can be no doubt. This effort is strain if the action is equal and simultaneous in all parts, holding the focal interval on the retina, or adjusting the rays of first one principal meridian and then those of the other, as vertical or horizontal lines may be viewed; it is strain if the ciliary muscle acts, as described by Martin, in sections the one opposite the other, thus, by altering curvature, developing a lenticular astigmatism correcting in whole or in part the corneal; it is also strain if the longitudinal fibers of Bowman are alone concerned in the effort of correcting the astigmatism by tilting the lens on an axis in a plane with the corneal meridian of greatest refraction, thus producing a lenticular astigmatism counteracting to some extent the corneal. In oblique astigmatism, as usually encountered, there is demonstrable necessity for action (strain) on the part of the obliques,† which, in these cases, is a factor added to the ciliary strain excited by the astigmatism. The strain caused by astigmatism is nearly always a source of annoyance to the patient and should, in all cases, be fully corrected, regardless of any and all other conditions.

Ciliary strain is an effort on the part of the ciliary muscle to increase the refractive power of the lens, as in hypermetropia, or to render it astigmatic, by tilting or otherwise, for the correction of a corneal astigmatism. This action, or these actions, of the ciliary muscle is from necessity brought into existence in very early life, and because of daily repetition becomes a fixed habit of the muscle, a habit whose existence continues in nearly all cases for a time after the cause for it has been taken away by properly adjusted lenses. If this is true who knows that his work has been correctly done, when he undertakes the correction of a refractive error while the ciliary muscle is allowed to continue at its old work? That glasses thus fitted often (for a time) give satisfaction is but a verification of the old adage that "guesswork is as good as any when it hits."

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*See Ophthalmic Record, No. 11, vol. 2. †See Ophthalmic Record No. 1, vol. 1.

How often do we find ourselves declaring what is a truth, that ophthalmology is more nearly a pure science than any other department of medicine? And is not this true mainly because of our perfect knowledge of the refraction of the eye and the conditions that result from errors of refraction? If there were no modifying conditions nothing could be more scientific than the full correction of errors of refraction, which could not be done accurately without first putting at rest the self-correcting power, the ciliary muscle. Since these modifying conditions are known and can be removed, it is the plain duty of every oculist to determine, by a most thorough and painstaking examination under the only favorable condition, suspension of accommodation, what the refractive errors are, even though, because of the existence of some known muscle error, he might know that it would not be proper to give fully correcting lenses at that time; for having cured the muscle error his record would enable him later to give the full focal correction. There is no condition of the extrinsic muscles which would be disturbed by a full correction of any astigmatic error; there is no astigmatic error which may not be partly concealed by ciliary strain.

In the work of refraction how fortunate for science and practice, for patient and practitioner, that we have at our command mydriatics, whose effect is to temporarily suspend the self-adjusting power of the faulty eye, during which period artificial correcting means may be accurately determined. While a mydriatic does not, in the least, interfere with any of our objective methods of examination, it gives greater accuracy to most of these. All must confess that the ophthalmoscope can measure more correctly the refractive error of an eye, when under the influence of a mydriatic than when it is not. The man most skilled in estimating the refraction of eyes by means of the ophthalmoscope must confess that it took both time and practice to enable him to voluntarily suspend his accommodation, with his eye on the dark side of the instrument; then how can he expect the patient, whose eye is on the light side of the instrument, to learn in a minute to suspend an involuntary power, one that is being stimulated into activity by the light that is thrown on the retina? When there is forced suspension of accommodation (by a mydriatic) in the patient's eye and acquired suspension of accommodation (by practice) in the observer's eye, then there can be some degree of accuracy in the measurements of the ophthalmoscope; otherwise there can not be.

The valuable objective examination of skioscopy could not be so well made nor could the results be so accurate, if done when the eye is uninfluenced by a mydriatic. Properly practiced, under favorable conditions, skioscopy, in addition to detecting and measuring myopia and hypermetropia, shows quickly the existence of astigmatism, the kind and the quantity, and approximately the location of the principal meridians. A method capable of doing so much should not be interfered with by an active ciliary muscle and a contracted pupil.

When we come to the method of ophthalmometry we find that an active accommodation neither hinders nor helps. Since the ophthalmometer deals only with the cornea, we know that its findings must be the same both with and without a mydriatic; for a mydriatic can effect no change in either the corneal curvature or the corneal reflection. If no effort on the inside of the eye was ever made for the correction of corneal refractive errors, as is true in the aphakial eye, and all errors of refraction existed in the cornea alone, we would then have, in the ophthalmometer, an instrument infallible in its findings; and the mydriatic could be sent into *innocuous desuetude*. Although ciliary action prevents our relying implicitly on the ophthalmometer, it is, nevertheless, a great aid in refractive work. Those who bought this instrument and then consigned it to the attic, if they will only bring it down again and cultivate its acquaintance a little more closely, will find in it a worthy friend. Those whose enthusiasm has led them to trust this instrument implicitly will, on more careful study, find themselves victims of

misplaced confidence, for the reasons already given in this paper. The great sin for which the ophthalmometer will have to account is that its introduction led to a vigorous renewal of the effort to discard the mydriatic in the work of refraction. If the mydriatic is an aid in objective examinations, and ought not to be dispensed with, it is still more essential when the subjective methods are to be resorted to, as they must be, if we aim at accuracy in our work.

In our subjective tests there are causes for error, other than activity of the accommodative muscles, but unfortunately none of them are so easily removed as the latter. For the stupidity of the patient under examination there is no perfect remedy; for the carelessness and haste of the operator there is a cure in the combination of knowledge of the conditions under study and a determination to do the best possible under the circumstances. When we resort to the use of the lenses of the test case our aim is to prove the "findings" of our objective tests. If the fixed habit of strain is not suspended by a mydriatic, though we labor long and earnestly, we can never be certain that what we have done is absolutely correct. No one has ever yet learned the art of coaxing the ciliary muscle into a state of rest. When capable of acting it is always trying to correct the error which your lenses are searching out. This subjective test, when unopposed by ciliary power, is soon satisfactorily ended. If the need of a sphero-cylinder has been determined, and yet there is a "modicum of doubt" as to whether the spherical part should be diminished and the cylindrical increased in strength, or vice versa, the confirmatory agency is the Jackson sphero-cylinder, the use of which can be depended on only when there is suspension of the accommodation. If a perfect knowledge of the full error of refraction in every case is necessary, and this knowledge can be attained only by the suspension of the accommodation, then the reasons against the use of the mydriatic can be easily disposed of.

As to the interference with the business of the patient, superinduced by the mydriatic: He comes to the oculist because of the fact that his eye strain interferes with his business in one way or another. Relief is what he needs, and what he should have, relief in the fullest sense of the word, not present relief only, but relief for the future as well. When told that his trouble is due to eye strain he naturally infers that if the cause of that strain is removed freedom from trouble will follow. He comes, possibly, from a great distance, and, though his business may need him at home, he is off seeking comfort, worth more to him than gold. He is a willing subject, and complains at nothing that is needful to be done. He is a young man—old men may suffer with eye symptoms brought on by strain of the extrinsic muscles, but not from ciliary strain—and his accommodation is active. This must be suspended if the full error is to be known. If he is left to choose, after a fair statement of his case has been made, he will agree to the loss of time that must follow the use of the mydriatic, for he wants the work done correctly. Methods and means that are correct for patients from a distance are correct for home people. As to the amount of interference with business, the difference is decidedly in the favor of the home man. Besides, the business man being a sensible man, will not complain at loss of time necessary in order that relief may come, for he remembers how his troubles have, at times, incapacitated him for effective work. There are few whose work in bank, store, or elsewhere can not be done for a reasonable time by a substitute. What is true of the man of business is true of all patients, lawyers, doctors, school-teachers, artists, sewing girls, etc. But the necessary loss of time from the proper use of a reliable mydriatic need not exceed twenty-four to forty-eight hours. If it were necessary, the patient might be sent at once from the doctor's office to the countingroom, or wherever his duties might call him. Of course, near seeing so quickly done would have to be effected by means of a temporary pair of lenses.

The mydriatic whose power is effective and yet, as compared with atropine,

evanescent, is the one that should be chosen. There are few ciliary muscles that will not respond to a solution of hydrobromate of homatropine of the strength of one-third grain to 20 drops of water, 10 drops of which, drop by drop every five minutes, should be put in each eye. In ten minutes after the last instillation the study of the refraction can be confidently commenced The work completed by both subjective and objective tests, within an hour and a half all told, a few drops of a one-five hundredths solution of eserine may be used, the same to be repeated the next morning early. The patient may then be sent about his business. By the next morning the effect of the mydriatic is entirely gone. As to the general inconvenience to the patient, this can be readily borne or modified by smoked glasses, etc. Systematic effects are rare, and can be combated by appropriate remedies, brandy and morphine. As to loss of time to the operator, this is a myth. While the muscle test and the correction of the refractive errors must be done by the operator, he can safely commit the use of the mydriatic to the office girl, whose time is not so valuable as his own. This method, too, is restful both to the doctor and the patient; for the muscle tests should always be made when the eyes are uninfluenced by a mydriatic. After the eyes are brought under the influence of the mydriatic the subjective and objective examinations of the focal errors are soon over, and the patient does not have to be reëxamined on the next day, nor at any other time, as a rule.

As to the objection that the mydriatic may increase tension to the point of exciting an attack of glaucoma: this objection can weigh but little when we consider that this danger exists only in persons beyond middle life; and that in these patients the ciliary muscle has lost more or less of its power, and a weak mydriatic serves to completely suspend what remains. In these cases, especially if the patients are beyond 55 years, the prime object is not to act on the ciliary muscle, but to dilate the pupil, in order that a thorough examination of the fundus may be made for the detection of central choroiditis so common in old people; also that the periphery of the lens may be examined for beginning opacities. When these conditions are detected early, as is well known, proper therapeutic means may check their progress, and make it possible for the patient to have comfortable vision during the remainder of life. Through the small pupil of the old these changes could not be readily detected. After the proper glasses have been determined and the fundus and lens have been thoroughly investigated the myotic should never be omitted if the patient is beyond middle life.

While advocating the complete suspension of the accommodation, that full knowledge of the refractive errors may be attained and made a matter of record, I would not be understood as advocating that the myopic and hypermetropic refraction should always be fully corrected in every patient at the beginning. On the contrary, in the light of our present knowledge, such practice should be avoided, not only for the comfort of the patient, but also for the credit of the practitioner. In the present state of our knowledge there is not a single reason for not correcting fully all the astigmatism that may be found in any case; but not so with the hypermetropia and the myopia that may complicate it. The relationship between the external and internal recti should always be known before prescribing convex or concave spherical lenses. This should be determined when the eyes are uninfluenced by a mydriatic.* The superior and inferior recti and the obliques may not be consulted when glasses are to be prescribed.

In prescribing spherical lenses for esophoric cases there is an absolute need for the mydriatic in its full power, regardless of whether the refraction is hypermetropic or myopic. If hypermetropia is associated with esophoria, the accommodation should be fully suspended, not only that the whole of the refractive error may

* See Ophthalmic Record No. 11, vol. 2.

be known, but that it also may be corrected fully. Such glasses will cure a part (the pseudo-esophoria) of the esophoric condition, if not all. As I have been able to show in a former study, the esophoria associated with uncorrected hypermetropia is not all due to the intrinsic power of the internal recti. Further observation leads me to suggest that, for every diopter of hypermetropia in each eye, there is a half degree of pseudo-esophoria (1 D. of H. in each eye would give 1 degree). What esophoria is left after giving a full correction of the hypermetropia must be cured by operation or exercise, or by both. A full correction of the hypermetropia should always be given in cases of internal squint.

When esophoria is associated with myopia the mydriatic should be used to full suspension of accommodation, that the very great error of giving an overcorrection of the myopia may be avoided. The exact correction should be known and recorded. The same may be prescribed for distant seeing without risk of adding a pseudo-esophoria to the true muscle error; but the fully correcting concave lenses should not be prescribed for near use, for the reason that the muscle error would be thereby increased. When the esophoria has been cured the full myopic correction should be worn for all distances.

In prescribing spherical lenses for exophoric cases, there is an absolute need for the mydriatic in its full power, whether the refraction is hypermetropic or myopic; for it is in these cases that the true error of refraction is most likely to be concealed, because of the spasm of accommodation caused by the exophoria. Exophoria often causes emmetropic eyes to appear to be myopic. It renders latent the greater part of a hypermetropic error, and adds a pseudo-myopia to the real myopia. The mydriatic alone is able to show the refraction of exophoric eyes in its true state. Without it, concave lenses will be selected by emmetropic eyes, not infrequently, under these conditions, hypermetropes choose concave lenses. While an overcorrection of myopia should never be given, the full correction of a myopia associated with exophoria should always be prescribed, and the patient should be directed to wear these lenses for all purposes of vision. While the hypermetropia associated with exophoria should always be known and recorded, the full correction should not be given, often no correction, until the muscle error has been cured by means at our command.

Orthophoria is rare, but when it exists a full correction of any and all refractive errors should be given. That an overcorrection of myopia and an undercorrection of hypermetropia may be avoided in these cases, the full suspension of accommodation is essential.

Instead of using the mydriatic once in 46 cases, have we not strong scientific reasons for using it 46 times in 46 cases? The human eye remains a human eye under the influence of the mydriatic, except as to its focal adjustment. In this respect it is no more than a machine, and is susceptible of perfect measurement by means of our several objective and subjective methods. In no other way can accuracy be attained. The unscientific cry of honest but misguided occulists against the use of the mydriatic is to the ear of the quack spectacle vender a sweet sound which he attunes to his own profit, and to the detriment of the unsuspecting public. May it soon be heard no more in the land.

ASTIGMATISM FOLLOWING CATARACT EXTRACTION AND OTHER SECTIONS OF THE CORNEA.

By EDWARD JACKSON, A. M., M. D.,
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In his work on the anomalies of accommodation and refraction of the eye, Donders stated, "To the very ordinary causes of altered and consequently irregular arching of the cornea belongs the extraction of cataract. Especially when prolapsus iridis or threatening prolapsus has existed, whereby the pupil has lost its central position, or where, with forward projection of the flap, the wound surfaces do not perfectly correspond, we seldom obtain a completely normal arching of the cornea. If the deviation is slight, the power of vision may still be quite sufficient; but on accurate investigation it now appears that the acuteness is defective, and the astigmatism is in this instance also partly capable of correction by giving an oblique position to the convex glass, or by combination with a cylindrical one." Since the publication of Donders's work almost every text-book upon the refraction or diseases of the eye has contained an allusion to the subject, but these allusions little more than call attention to the existence of such astigmatism. A few papers upon the subject have appeared from time to time, but, so far as I know, only one in the English language—namely, that by Dr. Swan M. Burnett, in the American Journal of Ophthalmology for 1889, page 361. In view of this, it seems worth while to here record some observations as to the clinical history of such astigmatism.

Frequency.—It appears to occur almost universally after cataract extraction. In a few of my earlier cases my notes do not show that it was detected. But in none of these cases was full vision, or nearly full, vision obtained; and they were not subjected to careful study with the ophthalmometer or the shadow test, so that their negative evidence is not conclusive. In 48 cases that have been carefully studied the amounts of astigmatism present were: Less than 1 D. in 5 cases, 1 to 1.75 D. in 6 cases, 2 to 2.75 D. in 18 cases, 3 to 3.75 D. in 10 cases, 4 to 4.75 D. in 4 cases, 5 D. in 2 cases; 6, 7, and 8 D. each in 1 case. From these statistics I am inclined to think that those who have found it frequently absent have failed to note it, as I did, in the cases previously mentioned, because it was not looked for carefully enough. It would appear from these figures not only that it is present in an amount that can be detected, but also that in a great majority of cases it is present to such a degree that its correction is a matter of considerable importance.

Direction of the principal meridians.—All writers who have alluded to this subject have noted, what is shown in my own cases, that, contrary to the rule, the principal meridian of greatest hyperopia was at or near the vertical, the section being made either upward or downward. This has been so generally observed that we may take it as settled that the meridian of greatest hyperopia is usually or always perpendicular to the center of the corneal incision. In many of my own cases the slight difference in height between the puncture and counter puncture clearly influenced the inclination of the principal meridians. The greatest departure from such a position of the principal meridians was in the cases presenting low degrees of astigmatism. In one case of astigmatism, 0.5 D., the flattest meridian was found 55° from the vertical. As to the explanations of the direction of the astigmatism, as well as of its occurrence, more will be said later.

Seat of astigmatism.—After cataract extraction this can only be in the surface of the cornea, and in cases of iridectomy, also, the ophthalmometer has invariably revealed that the asymmetry had a similar location.

Time of appearance and clinical history.—The first application of accurate methods for the measurement of refraction subsequent to the operation has invariably revealed the astigmatism present, and in the highest degree exhibited at

any time in that particular case. Inspection of the cornea, with or without the use of the Placido disk, from the date of operation shows that after the effects of cocaine have passed away and the humors have replaced the extracted lens the form of the cornea remains normal, although subject to changes by changing pressure from the lids, until the interior chamber is reëstablished. Then in the course of two or three days, or sometimes in a few hours, the corneal asymmetry becomes evident and quickly reaches its maximum. From this time on the tendency is for the astigmatism to diminish, until at length a permanent condition is reached. This diminution, however, is not always regular or constant, as was well illustrated in many of the cases. For example:

Mrs. J. M., aged 54: iridectomy for subacute glaucoma, corneal section upward, well back in the sclero-corneal junction, involving one-fifth of its circumference. The eye was operated on May 14, 1883. It had previously been carefully examined and found hyperopic 2 D. and free from astigmatism. The astigmatism was evident shortly after the operation. In five weeks it had markedly diminished, and +4 D. cyl. axis 25°, gave vision equal four-sixths. At nine weeks there had been no change whatever in the refraction, and the above cylinder was ordered for distance, with +3 sph. added for reading. Sixteen days later the patient wrote me complaining that the glasses had begun to hurt her eyes, and was instructed to discontinue their use. At fourteen weeks the refraction was again carefully tested and found to require for its correction +2 sph. ⊂ +2.50 cyl. axis 20°, giving the same vision. At eighteen weeks the same correction was required, but fearing further diminution of the astigmatism she was ordered for distance +2.25 sph. ⊂ 2. cyl. axis 20°. Four years later she required +2.75 sph. ⊂ +2.50 cyl. axis 13°, and with it obtained a vision of four-fourths, partly. There was no further change in the refraction when last seen, more than eight years after the operation.

In watching cases from week to week with the ophthalmometer, it has repeatedly happened that for some weeks the change in the astigmatism would be but slight, and then there would suddenly appear a rapid change to what proved to be the permanent condition. On the other hand, there will in some cases be a steady diminution of the astigmatism from the time it is first measurable until the permanent condition is reached. Thus:

R. C., aged 63, after simple extraction, upward section in the margin of the cornea had at 14 days, astigmatism 15 D. convex cyl., axis 155°; at 21 days, 13.5 cyl.; at 40 days, 11 cyl.; at 54 days, 7.5 cyl., now axis 157°; at 61 days, 7.5 cyl.; at 75 days, 5.75 cyl.; at 78 days, 5 cyl., axis now 158°; at 90 days, 4 cyl., axis 158°, giving a vision of four-fifths, mostly.

In nearly half of my cases capsulotomy was performed while the patient was under observation. No effect from it upon the astigmatism present could be noticed.

Final amount.—The amount of astigmatism remaining when its condition had become permanent is indicated in the table given in connection with its frequency. It should, however, be noted that all cases in which the astigmatism is given as over 4 D. were cases that have not been seen more than five months after the date of operation, and of the cases showing 4 D. but two were seen more than six months after the operation; so that it is uncertain whether in any case more than this amount of astigmatism has remained permanently. Although some of these cases are known to be within reach, and all were directed to report if their glasses became unsatisfactory, the one in which the astigmatism was 8 D. was seen only one month after operation. It is certain that in the large majority of cases the amount of astigmatism diminishes to less than 3 D. before it becomes fixed. And in a given case where it was necessary to adjust glasses within the period of probable change of astigmatism it would be safer to prescribe for this average amount than to take the measurement of the eye at the time if it indicated a higher amount, even though this might have been almost or quite constant for days or weeks.

When it ceases to change.—The period during which the astigmatism continues to diminish varies widely. In two eyes it decreased from 4 D. to 2.25 D. after a

period of six months had elapsed. In another case it had fallen to 2.25 D. by the twenty-second day, and no further change occurred, although the eye was seen for more than a year afterwards. In another case it diminished to 1.25 D. by the twenty-fifth day, and remained without the slightest change five years later. In still another, it fell to 1 D. by the twenty-third day. In about 60 per cent of the cases the change continued between two and three months, with perhaps a very slight diminution after this. In 15 per cent permanence was reached in the second month; in 20 per cent change continued after three months. Where the amount remains high at the end of this period, even though it has been for a considerable time stationary, there is strong probability that it will further diminish later. All of the cases long under observation, two of them for ten years, seem to show that after a certain period, limited apparently to the first year, or possibly a little longer, the amount of astigmatism becomes quite fixed and is as little liable to change as in cases of moderate astigmatism not due to operation.

Influence of complications.—The occurrence of prolapse of the iris or of incarceration, or even of close adhesion of the iris to the corneal stump, notably influences for a time the amount and delays the diminution of astigmatism, but these conditions appear to produce but little effect upon the final amount and permanence. The influence of prolapse in this direction, unless it be so extensive as to cause great displacement of the corneal flap, is not greater than the influence of incarceration or of adhesion of the iris to the cornea. In either case the influence appears to be proportioned to the extent to which the corneal wound is involved. Thus, a large incarceration is worse than a small prolapse. In the series of cases upon which this paper is based, there occurred two of extensive prolapse of the iris allowed to shrink without excision or other operative interference.

W. J., aged 70, by a sudden movement of the eye during the corneal section, caused a doubling of the incision that left about one-third of the margin of the flap hanging as a shaving of corneal tissue, almost completely severed from its connections. This underwent partial absorption, delaying the healing of the wound, and the restlessness which had caused the original accident secured an extensive prolapse of the iris. On the twenty-sixth day he still had 10 D. of astigmatism, which, however, had diminished to 3.50 D. by the seventy-seventh day, and after that underwent no change.

J. W., aged 42, had a bit of steel lodged in the lens four months previously. The lens was much swollen, and in order to make sure of the removal of the foreign body, a long incision well back in the sclero-corneal margin was employed. Prolapse of the iris occurred and extended until it occupied the whole length of the wound. It reached its maximum in a few days, and then remained without notable change in bulk for thirty days, after which it flattened rapidly, and by the forty-fifth day had gone down entirely to the level of the cornea. On the fifty-first day the astigmatism was 20 D.;* on the fifty-eighth day 11 D., at sixty-five days 9 D., and only after five months has it reached 5 D.

In contrast to this is the course of the astigmatism in the following case:

Mrs. J. G. B., aged 64; simple extraction, normal healing; on the twenty-fifth day, astigmatism 26 D.; on the twenty-eighth day it had fallen to 23 D., and in two months and a half to 0.75 D.

Nature of the change in the cornea.—The readings of the ophthalmometer show, first, that the corneal curvature is actually diminished in the meridian of least refraction, usually vertical, or nearly so, and that this meridian is flattest at the first examination and becomes more convex as the astigmatism diminishes; second, that the meridian of greater curvature, usually horizontal, or approxi-

* The numbers of diopters in this and the following case are, what was indicated by the Javal ophthalmometer, considerably higher than the convex cylinder accepted. Thus when the olphthalmometer showed 11 D. the 10 D. cylinder was chosen. When it showed 23 D. the 18 D. gave the best vision. This is partly because of the distance of the cylinder in front of the eye, and partly because the constants taken as the basis of the graduation of the Javal instrument do not hold for the eye rendered aphakic by cataract extraction. (See paper by Dr. Carl Weiland, Archives of Ophthalmology.)

mately so, presents an actual increase over the previous curvature of the cornea, which increase is greatest at the first examination and diminishes with the astigmatism; sometimes, but not always, passing away altogether by the time the condition of permanency is reached. To explain these corneal changes, the pressure of the lids, the displacement of the flap, and the action of the extra-ocular muscles upon the globe have all been invoked, but the astigmatism occurs, typical in form and course, when the flap and stump unite in perfect coäptation; and the pressure of the lids and action of the extra-ocular muscles have not been shown to differ essentially from their pressure and action on the normal globe. It seems to me that the explanation of the phenomena of post-operative astigmatism is to be found in the essential fact of an incision through the resisting coat of the eye, temporarily entirely destroying its resistance along a certain line, and that the necessary effects of such an incision, irrespective of any outside influences, are just such as we have observed in cases in question. With the incision the resistance of the sclero-corneal coat to the intraocular tension along the line of incision drops to zero and remains there until the flap and stump adhere. During this time that the wound remains open the intraocular tension also remains at zero, and no displacement results. When, however, the wound is closed the intraocular tension is immediately renewed and the adhesions uniting the flap and stump become a portion of the sclero-corneal coat, which has to resist this tension. Throughout most of this coat the power of resistance is normal, the adhesions possess comparatively little power of resistance, and the changes in the neighboring margins of the flap and stump incident to the process of repair materially diminish resistance. It follows, therefore, that we have along the line of incision less resistance to the intraocular pressure than at any other portion of the sclero-corneal sac; necessarily the parts where the resistance is less protrude. This protrusion causes great increase of curvature in the direction perpendicular to the incision at the line of incision; and this increase of curvature must necessarily be made up by an equal amount of flattening of the neighboring portions of the cornea and sclera. In the sclera, this flattening being of no practical importance, remains unnoticed. In the cornea it causes the flattening of the vertical meridian. So much for the flattening in the meridian perpendicular to the incision. It is noticed that the change of outline that occurs is dependent on the bulging of the point of least resistance. The maximum of this bulging will be at the center of the corneal incision; that is, the center of the corneal incision is more pushed out from what would be its normal relation to the center of the globe than any other point of the sclero-corneal coat; and the whole area of the central part of the flap shares more or less in this bulging. We have, therefore, the center of the upper part of the flap bulging forward. If other parts of the circumference of the cornea remain fixed, as the whole cornea does outside of the region of incision, and as the angles of the incision do, to a less extent, because of the support they receive from neighboring firm tissue, this bulging at the upper margin of the cornea causes the cornea to assume more or less the form of a vertical ridge, comparatively flat in the direction of its length, but with increased curvature from side to side. And in this increase of curve, to get over the ridge as it were from side to side, we have the cause of increased curvature in the meridian of greatest curvature.

This explanation is put forward not as an hypothesis, but as an application of perfectly understood physical laws to the special case of intraocular tension, resisted by the sclero-corneal coat, weakened along a certain line of incision, and seems to me entirely adequate to the requirements of the phenomena in question, rendering unnecessary any appeal to other special causes to explain post-operative astigmatism. As the resistance along the line of incision increases with the return of the tissues to normal, the tendency of intraocular pressure is to reproduce the

normal spherical curves, or the spherical curves of the normal eye. That it should fail of doing this completely is not to be wondered at when one considers the existence of the permanent scar and the comparative rigidity, on account of the age of the patient, of the tissues in which this process generally occurs. The influence of such complications as prolapse or incarceration of the iris is clearly traceable to the fact that they produce softening in the adjoining margins of the flap and stump, and delay their return to the conditions of normal corneal tissue.

Choice of operation and after treatment.—The hope has been expressed that with an increased knowledge on the subject of post-operative astigmatism, we would be able to choose or devise some special form of operation that would reduce it to a minimum or prevent it entirely. But if the cause lies in the essential fact of an incision into the cornea that necessarily lessens its resistance, this hope will have to be abandoned. All we can do in the choice of an operation will be to keep the incision out of the visual zone of the cornea, and to secure prompt and complete healing. The thought will occur that if the bulging could be prevented by the proper outside pressure, the astigmatism would be prevented. But, as I have already urged in a paper before the American Medical Association, in 1891, any such application of pressure is impracticable and the attempt certain to be injurious. Where prolapse or incarceration of the iris has occurred, the removal of the involved iris may hasten the condition of permanence, but will not diminish the ultimate amount of astigmatism sufficiently to justify a resort to it on that account.

The correction of post-operative astigmatism.—Many of those who recognize its existence speak of it as unimportant, or to be corrected not by a cylindrical lens, but by the placing obliquely of a spherical lens. The need of the improvement of vision gained by the correction of 1 or 2 or 3 D. of astigmatism is as great for a patient who has undergone cataract extraction or iridectomy, and so speedily acquired the astigmatism, as for a patient in whom the astigmatism is congenital, or of slow development. The imperfect visual acuteness often present in the former class of patients is, I believe, more than balanced by the fact that astigmatism is new to them. Even if its correction will not give as good vision as may be obtained by the correction of some case of congenital astigmatism, the fact that the patient has been accustomed to seeing without astigmatism will cause him to appreciate as highly the relief afforded. In any case of cataract extraction that can be properly classed as successful, it seems to me important to correct the astigmatism.

Now, as to the method of correction. Theoretically, it is true that by looking obliquely through a strong spherical lens regular astigmatism may be corrected, but, as I pointed out in a paper read before the American Medical Association, in 1887, on the effect of obliquity of correcting lenses, such a correction is far less satisfactory and far less beneficial than the correction by the ordinary cylindrical lens. The proper cylindrical effect is only obtained at a certain angle and at an angle where the slightest deviation either way produces a perceptible change in the cylindrical effect, so that the patient who gets his cylindrical effect by looking obliquely through a spherical glass is constantly getting, instead of the proper effect, not enough or a little too much. On the other hand, with the cylindrical lens, and the visual axis perpendicular to the lens, there is a considerable angle to either side of the perpendicular through which the change of cylindrical effect is imperceptible; and on this account, if the lenses are properly mounted, it becomes difficult for the patient to get a cylindrical effect which will be seriously incorrect. One other point. The reason urged for not employing a cylindrical surface upon the cataract glass is that it renders necessary the use of a more convex spherical surface, increasing the weight of the lens and the amount of spherical aberration. The increase of weight in a plano-spherical over a double convex that is absolutely necessary is so slight as to be of no practical importance. The increase that happens in the use of such lenses in practice depends on the inferior selection

and grinding of the lens by the optician. The spherical and chromatic aberration of even a strong cataract glass, especially through the small pupil obtained by simple extraction, are not the most serious defects in a strong lens. The effect of looking obliquely through the lens is of much greater practical importance. And by placing the spherical entirely on one surface, if convex, the surface away from the eye, we secure an approximation to the ideal periscopic lens, one which should have the center of its refractive surface at the center of rotation of the eyeball, and reduce to the minimum the effects of looking obliquely through the refracting surface. Indeed, so important is this matter that where the cylindrical lens was to be employed in connection with the strong spherical, I have used the concave cylindrical with the convex spherical, turning the former toward the eye, the latter from it, and have found such a lens as satisfactory or more satisfactory than those made with both spherical and cylindrical surfaces convex.

The teaching of the non-correction of astigmatism after cataract extraction seems to me utterly opposed to good sense, and practice based upon it is only excusable on the ground of an insurmountable constitutional indisposition to do thorough work.

A FEW THOUGHTS ABOUT OPHTHALMOMETRY: AS TO WHAT THE JAVAL INSTRUMENT WILL DO, AND WHAT IT WILL NOT DO.

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The value of the ophthalmometer as a factor in the determination of the axis and amount of astigmatism has for the past few years given rise to considerable controversy. According to some it would seem as though the ophthalmometer had supplanted the subjective test, rendering the use of mydriatics unnecessary, and those who used them liable to be considered old fogies, too "sot" in their ways to appreciate the value of the more perfect and scientific method. Others consider it little more than a toy whose popularity will be ephemeral, and content themselves with the assurance that it, like many other medical fads, rests on an insecure foundation and will therefore soon be a thing of the past. Again, there are those who consider the instrument a scientific one, constituted on proper principles, and not a toy; yet know that the scope of its work is limited, and have endeavored to get from it all that is possible, and while acknowledging its great usefulness, realize its limitations.

Those who have used the ophthalmometer, in other words, those who from experience know something of it, naturally belong either to the first or third group. Originally the larger number of them belonged to the first class; but the third or conservative class has been steadily growing, and now contains quite a respectable number of the thinkers, or, in other words, it contains the workers and reasoners, and not the enthusiasts. The main reasons for this difference of opinion consist, firstly, in a faulty construction of the instrument; secondly, to a faulty use of it; and thirdly, a wrong interpretation as to what can be accomplished with it.

Glancing for a few moments at the different ophthalmometers, we have to consider, first, the original instrument constructed by Helmholtz in 1853. This instrument is really perfect in construction, giving us most accurately the radius of curvature at any part of the cornea desired. Its results are accurate, but its use entails the expenditure of a large amount of time. To thoroughly measure the cornea at any point necessitates at least sixteen separate readings. It has been used by Knapp, of New York, and Strawbridge, Wieland, and others, of Philadel-

phia. All testify to its accuracy and perfectness, but consider it more valuable in the laboratory than the office. The ophthalmometer of Le Roy and Dubois has the disadvantage of being poorly constructed, the hinge and other joints being loose; in fact, nearly all the fittings are inaccurate. There is no means of steadying the head so that the eye may be fixed while being measured; the scale is inaccurate; the bar on which the mirrors or reflectors ride is straight, whereas it should be an arc of a circle with a radius equal to the distance of the scale from the eye being examined. It has no means of artificial illumination, while requiring for its proper use a very strong light. Some pretend that by its use the refraction of the eyeball can be determined. The claim is, however, too absurd for discussion, as it must be evident that it is a physical impossibility to determine this objectively. The Javal-Schiotz ophthalmometer of 1889, if mechanically well constructed, is a good instrument. Its most frequent defects are a displacement or a malposition of the Wollaston bi-refrangent prism, a displacement of the arc upon which the scale is constructed and the mirrors move, the want of a means of keeping the patient's head fixed while under examination, and an insufficient illumination. In the Javal instrument (model of 1889), of French construction, the base is too light, it does not keep the telescope and head rest in a fixed relation to each other, and in the general workmanship it is markedly inferior to that of American construction. A malposition or displacement of the Wollaston prism is frequent. Instead of the primary image revolving about its center with the revolution of the telescope, it has, in addition, another motion about an imaginary center, the secondary image in either case moving about the primary one. This double motion of the primary image is due to a faulty position of the prism, and before using such an instrument it should be carefully overhauled, as all results obtained under these conditions are absolutely worthless. If the arc be not in proper position, if it is not at all points exactly the same distance from the eye, again are the results valueless. The screws by which the arc is fastened to the barrel of the instrument must be very carefully adjusted. In order to test the arc a lens with a refractive power of its anterior surface of about 32 diopters should be placed at the rest of the instrument. If, as the telescope is revolved, there be the slightest break in the continuity of the black lines of the *mires*, it indicates that the arc is still improperly adjusted.

With a properly constructed instrument, a good illumination (four incandescent lights of 16 candle-power each being undoubtedly best), the apparatus firmly secured to a good stout table, and the patient's head firmly fixed (strapped in the head rest), the results will be trustworthy and accurate. It is for us to interpret the results.

Here let us pause and inquire as to what has been expected of the instrument, and how far our anticipations have been realized. There are those who have assured me that it would measure the refraction in any meridian. It is with this idea in view that the scale of the Le Roy-Dubois instrument is constructed. Physically, as before mentioned, this is an impossibility and can not be accomplished. Others consider that it will invariably give both the axis and entire amount of astigmatism of the eye. This it will do only in such cases where the astigmatism is confined to the anterior surface of the cornea; but the astigmatism may not be confined to the cornea, and therefore lenticular astigmatism must be considered, as must also the fact that the posterior surface of the cornea may not be parallel with the anterior; if this be not so, it will influence the astigmatic refraction. In other words, ophthalmometers deal with the cornea only, and are therefore, strictly speaking, keratometers and any knowledge of other parts of the eyeball that they may reveal to us is obtained by a comparison of our other studies with those of the keratometer. In fact, all we obtain is a knowledge of the anterior surface of the cornea, its radii of refraction, its irregularities, and some idea of the transparency and nutrition of its superficial layers. When once this fact

is thoroughly realized there will be fewer disappointments, as well as fewer enthusiastic outbursts than have up to this time characterized the progress of these studies. By means of the keratometer we can measure the corneal area, its curvature at any or all parts, and learn the angle of the axes of the principal meridians at the part under examination, as well as the difference between the radii of curvature at these or any intermediate points, and can thus determine in diopters, the difference in corneal refraction at these points. In addition to this, the instrument has in my hands proven valuable in determining problems as to the nutrition of the cornea, and as to increase or decrease of the intraocular pressure.

My first keratomic work was done with a Helmholtz instrument, but I am now using the Javal instrument entirely, and with it have examined over 1,800 eyes of over 900 patients. In all cases of refractive errors or diseases of the eyeball or its appendages (with the exception of a few cases of acute inflammation of the iris, cornea, and conjunctiva), in addition to the routine examination, a keratometric examination is invariably made. Of these over 1,400 eyes have been thoroughly examined and tested while under the influence of a mydriatic, either atropine or homatropine. As a result of these examinations I have found that the axis of astigmatism, as determined by the keratometer, corresponded to the axis as determined by the mydriatic in 88 per cent of the cases, while the degree corresponded (after making the correction of 0.37 diopters, subtracting it when the astigmatism is with the rule and adding when against the rule) in 45 per cent.

It is an admitted fact that the astigmatism of a ball is not always confined to the cornea: that not infrequently it is lenticular. Of this we have two varieties, the static and the dynamic. In the dynamic variety, supposed by some to be a compensatory effort to overcome the effects of the corneal astigmatism, usually all that is necessary is to carefully correct the corneal astigmatism, the dynamic lenticular astigmatism then disappearing. In the static variety, the ophthalmometer can not give us the total astigmatism. In these cases we must proceed to the estimation and correction of the lenticular astigmatism as well. It is these cases that in the whole range of refraction work gives us the least satisfactory results. In the examination of corneæ which have been subjected to weakening of structure in consequence either of local inflammations or systemic disorders; cases where the results obtained by glasses while under mydriatic influence are either indifferent or nil, because of irregularities in curvature or in the transparency of the corneal layers; we can often get very good results through the aid of the keratometer. By instilling a few drops of castor oil on such corneæ we are often enabled to get very clear images, and can thus determine the axes of the principal meridians and the difference in diopters between their refractive powers.

The approach, advance, and subsidence of glaucoma has been made more noticeable and marked by the changes in the axis and curvature of the cornea and changes in the brillancy of the keratometric images than by any other method of examination.

In developing myopia it will soon show the suspicious nature of the case, and in progressive malignant myopia the changes are frequent and marked. I have often noticed that irritable retinas are associated with corneæ whose axes and curvature vary, and now I always seek for the latter whenever I find the former. In corneal malnutrition dependent upon syphilitic disease the changing of the axes and curvatures, with a loss in the brilliancy of the reflex, precedes an inflammatory attack, and if this condition be appreciated, serious results will often be avoided. In refracting cases of aphakial eyes, and in refracting shortly after injuries of the cornea, and after operations involving the cornea, its value must be evident to all, giving us results which often we could not obtain without incurring possible danger from irritation and subsequent inflammatory action. Some of the intricate problems regarding the construction of the eye, its depth

and diameters, its lens astigmatism and refraction, can be determined by means of calculations from the data as furnished by this instrument, as compared with those as furnished by the subjective examination under full mydriasis.

Now, briefly outlining, we find that the ophthalmometer will not give us the refraction, nor will it give us the total astigmatism except when this is confined to the cornea, or any knowledge as to whether there is or is not lenticular astigmatism. It will give us the axis and degree of astigmatism when this is corneal. Practically we find that it gives us the axis in 88 per cent and the amount of astigmatism in 45 per cent. It reveals to us a knowledge of diseased conditions of the eyeball when the disease is of such a nature as to interfere with the corneal nutrition or to increase or decrease the ocular tension. It will, in connection with other methods, allow us to calculate the lenticular refraction and astigmatism as well as the depth of the eyeball, and thus puts within our grasp a new method of more thoroughly studying its functions and anatomy.

DISCUSSION.

Dr. Risley said: I congratulate myself on the fact that the task before me is a pleasant one, since I am in practical agreement with the views expressed in the several valuable papers presented. I am much interested in Dr. Belt's researches regarding the eyes of white and black school children. He had kindly referred to the Philadelphia school examinations. In that work the main endeavor, however, was to show that the universally recognized increase of myopia during the school life was due in large measure to existing astigmatism, which seemed to be confirmed by the fact that in astigmatic eyes, it was shown, were discovered the commencement of those pathological states of the choroid which, in their more advanced states, were characteristic of the myopic eye, while in emmetropia or simple permetropia or myopia, not only were these changes absent, but the eyes were comparatively free from asthenopia. In the management of refractive errors I feel it important, first of all, that emmetropia should be accepted as the model eye and all departures from this accepted as defects, and when pressure in asthenopic eyes should be corrected by glasses. As to the methods to be pursued in the management of these cases, it should differ widely in different cases when the choroid and retina are practically healthy; in many instances approximate corrections will secure the comfortable use of the eyes, and may be made without the use of a mydriatic, or with the careful use of homatropine; but in cases of retino-choroidal irritation, with their woolly or "ripe-peach" eye grounds, time is an important element in their treatment; hence any endeavor at rapid correction was liable to prove futile. In late years a very large percentage of the cases I have seen had bad eye grounds and needed the mydriatic, not only to paralyze the accommodation, but as a therapeutic agent. In such cases the drug should be employed until the turgid state of the intraocular tunics subsided, when the correcting glasses would be chosen with but little difficulty. It required time to accomplish this, and while the same end could be reached with the employment of homatropine it should be applied more frequently and must be used longer than the stronger mydriatics. For this end he preferred hyoscyamine, and although the resulting effort was more enduring than that of homatropine, the total time of detention from work was no longer, and on the whole more satisfactory and less annoying to the patient than the prolonged and frequent instillation of homatropine. Regarding the use of the alkaloid disks, after a persistent trial he had returned to neutral solutions in water. When combined with cocaine they caused increased lachrymation and the tears either diluted the alkaloid or washed it away. Then, too, the cocaine lessens the intraocular tension and often disturbs

the corneal epithelium. Solutions in oleaginous substances, he quite agreed with Dr. Wood, were inadmissible for the reasons stated, as he had ascertained by trial in 1875. No mention had been made of the later chemical results in the manufacture of the mydriatic alkaloids. If the alkaloid is extracted from atropa belladonna in the presence of an alkali or of great heat the product is atropine, but if no alkali is employed and only low temperatures used, hyoscyamine is the resulting product, while, on the other hand, in the presence of high temperatures and an alkali, atropine is the product, even from hyoscyamus nigra. It was important, therefore, that in dispensing hyoscyamine sulphate that the solution should be neutral and made at low temperatures. Recently, preparations of sulphate of atropine and sulphate of hyoscyamine were given by me to Dr. Marshall, of the University of Pennsylvania, and neither of the drugs showed any paralyzing power, hitherto the only means, except their physiological properties, of differentiating them. It would therefore appear that the products now in the market, certainly those from Merck's laboratory, are both hyoscyamine, and that we get atropine only through the careless manipulation of the druggist. A 1 per cent solution of duboisine to hyoscyamine was too strong to use in the manner suggested by Dr. Wood and would in many cases give rise to toxic symptoms.

In reply to Dr. Savage's paper I would say that I am in full accord as to the urgent necessity for mydriatic corrections if we are to secure any but the barest approximations to the static refraction of the eye. I can not, however, agree on the statement that old men do not suffer from eye strain. The ciliary muscle is still present and susceptible of contraction however futile its efforts may be over the now flat and inelastic lens. This is frequently demonstrated in the irritable eyes and headache of old people, reading or working with an improperly adjusted glass. In these conditions a mydriatic often gives as great relief from these asthenopic symptoms as in younger people. The pin-point pupils of people at 50 years reading without glasses, or with too weak glasses, demonstrates still further the existence of eye strain, and hence the frequent need of a cycloplegic after 40 years of age. I have no fear of the glaucoma ghost which has been held up before us from the use of mydriatics in middle life. I have used them in thousands of people beyond the mydriatic dead line, and no harm has ever followed. It would, of course, be folly to use them in cases where glaucoma was imminent, or in suspicious cases. These should be excluded. I do not believe the spasm of accommodation is by any means confined to cases of exophoria, as I have frequently seen marked spasm which has disappeared under prolonged use of mydriatic and no exophoria was demonstrable. My own experience is in accord with the teachings of Dr. Jackson's paper. The astigmatism following operations which opened the anterior chamber, I believe, occurred quite uniformly. I have recently performed extractions in two cases in which the existence of astigmatism has been demonstrated before extraction, the axes of the correction cylinder being required at 90°. After extraction a much higher grade of astigmatism was present with the axis of the correcting cylinder at right angles to its former position. My experience also showed a more or less rapid diminution of the astigmatism found to exist two weeks after extraction. The permanent degree probably averaged about 1.25 D. and the axis of the cylinder was ordinarily required approximately parallel to the line of the cicatrix.

I was much pleased with the admirable statement by Dr. Lautenbach of the proper values of the ophthalmometer. I use it quite constantly as an addition method, but I can not trust it sufficiently to justify me in ordering cylinders by its readings since, in a careful analysis of 200 eyes, subsequently corrected under mydriatics by subjective examinations, 25 per cent showed important discrepancies.

Dr. Burnett said: I was interested in the statement of Dr. Belt that he had found approximately the same number of squints in the white and colored children.

My own experience in clinical and private practice has been that squint, especially of the concomitant form, is very rare in the negro. I coincide fully with Dr. Jackson, since the results as reported by him as to astigmatism following cataract extraction are in accordance with my own, published three or four years ago. He did not think that on the average the eye regained its final shape after an extraction, on an average, under two months. I think Dr. Lautenbach's estimate of the ophthalmometer just. It would give us only the astigmatism of the cornea, but is, on the whole, one of the most valuable instruments we have, and if once used understandingly would never be given up. It did not give us the lenticular astigmatism directly, though it had done more than any other instrument to demonstrate its existence. (He gave the history of a case examined that morning which showed that neither the ophthalmometer nor the shadow test could be relied upon implicitly). In this case the shadow test showed those internal shadows of which I have spoken at a late meeting of the Ophthalmological Society, and whose presence indicates, in my mind, some irregularity in the refraction of the lens, and made the findings of the shadow test unreliable. I am of the opinion that in some particulars the old instrument of Javal is the better, particularly as to its prisms.

Dr. Gould thought that in the great majority of cases of eye strain without complicating disease, the long-continued use of a mydriatic as a therapeutic agent was an unnecessary tax on the patient. The glasses are the therapeutic agent. Physiologic action, not paralysis, is true therapeutics. He finds that homatropine and cocaine in pure solutions, properly exhibited, give perfect mydriasis.

Dr. Snellen said: Dr. Jackson stated this morning that operations for cataract or iridectomies are always followed by astigmatism. I quite agree with him that this is due to the loosening of the tissues and the bulging of the sclerotic. The more the wound is in the sclerotic the more astigmatism one gets. After a paracentesis of the cornea no astigmatism occurs. Up to now no one knows to what the good effect of iridectomy is due. My father, Professor Snellen, started the idea that it was due to this astigmatism, or rather to the cause of it: the bulging of the sclerotic which opens the perilenticular space. Priestly Smith, of Birmingham, sought the cause of glaucoma in closing of this space.

Dr. Hansell said: My experience in refraction of aphakial eyes agrees in the great majority of cases with the observations made by Dr. Jackson, that astigmatism diminishes during the few months following the cataract extraction. I have had, however, a case which has proven an exception. Four weeks after operation I prescribed $+12 \bigcirc +4$ cyl. ax. 180°. Four months later I reëxamined and discovered that the astigmatism had remained unchanged but that the Hypermetropia had increased to 16°.

Dr. Baker, of Cleveland, Ohio, said: I am pleased with the conservative character of the papers read; and yet I suppose that every ophthalmic surgeon is at liberty to use his own judgment and experience as to the choice of mydriatic, and the method of examination, either objective or subjective. When a patient presents himself at my office complaining of eye trouble, immediately after making a few general inquiries I take him into the dark room and examine him with the retinoscope. This examination should be made in a large dark room and without a mydriatic. Many of the difficulties complained of by Dr. Burnett in his case this morning will not be met with in the undilated pupil. The inability to discover the point of reversal in retinoscopy with the dilated pupil, I think, is often due to an irregular refraction at the margin of the lens. I then test the patient with the Snellen test type and trial lenses and if I get the same result as in the retinoscopic examination I feel perfectly justified in prescribing lenses without resorting to mydriatics, and I think these include fully one-half of my refractive cases, not including presbyopic ones. My cases do not all come to me because of

pain and eye strain; in fact, a large percentage come for imperfect vision, and if I can improve the vision without using mydriatics I see no occasion to subject the patient to the inconvenience of their use. I frequently make an exception in cases of low degrees of myopia. An overcorrection in these cases would prove disastrous. There is no danger of overcorrecting hypermetropia, and an undercorrection is not objectionable; and the amount of astigmatism can be accurately measured by retinoscopy. In low degrees of myopia I frequently use homatropine. I thoroughly believe with Dr. Risley in the therapeutic value of atropine in cases of eye strain, even though no pathological changes can be discovered in the fundus. These overworked eyes need rest. Frequently it is impossible to send these cases to the mountains or seashore, and the best substitute I can subscribe is absolute rest for two or three weeks under atropine, and I frequently prescribe it for this purpose. Parents often will not remove their children from school, and I take this method of enforcing my demands. I find the presoptometer of the late Dr. Culbertson of much use to me in cases of amblyopia in young children who can not read and in ignorant, dull people as a substiute for the test type.

Dr. Kollock, of Charleston, S. C., said: My experience with the negro shows a much greater percentage of corneal disease than has been incidentally mentioned by Dr. Belt. In my practice among the negroes more than 37 per cent of all diseases were corneal. With regard to strabismus in the negro I agree with Dr. Burnett that it is never seen in the pure-blooded negro except in cases of corneal defects, paralysis of the orbital muscles, cataract, or disease. In the mulatto it is not uncommon, though not as frequent as in the white. I think in testing these troubles in the negro care should be taken to state whether they were mulattoes or pure negroes. The mulatto has all the refractive troubles seen in the white, though not as common; the pure-blooded negro has little refractive trouble, slight hyperopia, and rarely myopia. With reference to Dr. Jackson's paper, I have seen an interesting case of corneal astigmatism following a corneal section for glaucoma. This section was made with a lance knife. The anterior chamber filled with blood, and tension instead of being reduced became of strong hardness. This continued for two days and vision was nil. Weak solutions of eserine failed to reduce the tension and the 4-grain solution was used with the result of rapidly reducing tension and restoring vision. This vision was 15, and no glass or combination of glasses would improve, but the stenopœic hole gave $\frac{15}{30}$. About a month later vision was brought up to this point by a compound lens.

Dr. Tiffany, of Kansas City, said: Dr. Belt in his report of the examination of school children, white and colored, says that he notices that some of the hyperopes after a few years increased in their hyperopia. We can readily understand how an eye can appear or even become emmetropic. My examinations of school children and students show many pupils of 10 to 12 years with a fraction of 1 to 2 dioptres become at 18 or 20 absolutely emmetropic or even myopic, but never more hypermetropic. When we speak of hypermetropia we mean the static refraction and not the dynamic. The dynamic conceals the hypermetropia to a great degree. I remember one patient, a young lady of 20, a teacher, who came to my office with $\frac{20}{40}$, but, with the dynamic set aside, her vision was $\frac{5}{200}$ requiring a + 6 D. to gain $\frac{20}{20}$. The fact is that hypermetropia does not increase but myopia does.

Dr. P. D. Keyser, of Philadelphia, said: I regret that I was obliged to leave this morning before hearing all the papers read, my duties requiring my attendance in the section of hygiene for the time, but to the remarks of Dr. Kollock in relation to the negro never having myopia I must say that there must be a difference in the eyes of the black race in the South from those in the North, although our confrères of the South have much greater advantage in seeing more eyes of the negro than in the North, but in my experience of more than twenty years in the Wills Eye Hospital, of Philadelphia, I have found several that we call pure negroes suffering

with well-marked myopia as well as compound myopic astigmatism. One case, near my office, of a very dark coachman of a well-known physician of our city wears 6 spherical, and only last week I fitted a compound myopic astigmatism. Really, in my experience I find as the negroes are being educated to read that their attention is being called to the defect in vision and they seek assistance, and in proportion as these educated persons come to my clinic I find almost an equal defect as in the white. In relation to Dr. Jackson's paper on astigmatism following cataract extraction, I desire to state that v. Graefe in 1883–84 called attention to the defect after his modified linear incision, and I have noticed it in all extractions by any form or place of incision, as well as in iridectomy. I look at it being caused by the swelling and thickening of the cicatricial edges of the corneal incision in the process of healing; always soon after the healing of the wound the irregular curvature of the cornea is much greater than is found after several months. It is very frequent that it is necessary to change the cylinder six, twelve, and twenty-four months after from the change in the cornea caused by the shrinkage of the cicatrix. It is very rare that astigmatism is not found in operations on the cornea which requires correction for good vision. I agree with Dr. Savage in the necessity for complete paralysis of accommodation in many cases of examination and adjustment of glasses; especially is it necessary in small children who have strong muscular power and unable to aid the examiner. Homatropine and such remedies do very well in adults and are mostly sufficient, but are not so in children. With them atropine to complete suspension of accommodation gives the best result in many cases. But judgment is necessary in making a full correction. I find many cases in which it is impossible to put on the glasses found correcting the defect. A certain amount of play of accommodation must be allowed to relieve the patient from discomfort.

Dr. Dean, of Scranton, Pa., said: I have not, during this discussion, heard any one raise the question of the mydriatic producing a low grade of hypermetropia during its action in an eye otherwise emmetropic; therefore I rise to bring forward that subject. In my experience the mydriatic often produces 0.50 to 0.75 of a dioptre. Dr. Savage did say that he did not always fully correct the hypermetropia. I have had a few cases where I had glasses made with the correction with the mydriatic to change to the correction without a mydriatic.

Dr. Allen, of Pittsburg, Pa., said: I advise simple and direct methods for the examinations of the refraction of the eyes, employing the test case and test card, not regarding retinoscopy and ophthalmometry as of the greatest practical use. I examine the eye under the full effect of atropine. I have the patient wait until the effect of the atropine has passed off before the glasses are prescribed.

Dr. Zeigler, of Philadelphia, Pa., said: Referring to Dr. Jackson's paper on astigmatism following cataract extraction, I wish to place on record two cases of very high astigmatism, amounting to C+6 D. ax. 180° in one patient and C+8 D. ax. 10° in another. These cases occurred during my service as house surgeon at the Wills Hospital, and, notwithstanding Dr. Love's remarks I do not think there is more astigmatism under the use of the simple dressing of court-plaster, suggested by our president, and I strongly prefer the lighter dressing. I have recently refracted two presbyopes in whom the astigmatism was irregular. The last case showed C+2 D. ax. 180 — C — 1.25 D. ax. 30. I desired to order S+3 D. in the bifocal slip, and have had both these cylinders ground on one side of glass, leaving the other side plane for the application of the bifocal sequent. This was ground on the principle of the "tonic" lens, by Borsch of Philadelphia, and I herewith show such a lens. My habit is to use complete mydriasis for all cases under 45. The stronger solutions of atropine are used before 40 and hyoscyamine sulphate after that age. I can not rely on homatropine, and only use it when I can not avoid it. I use a solution of 16 grains to the ounce. In a recent case, aged 49, I was not

satisfied with the homatropine, and changed to hyoscyamine. While the result in one eye was the same as in the previous test, the other one showed a change in cylinder and a change in the axis. It is these occasional failures that shake our faith in the weaker mydriatics.

Dr. Young, of Burlington, Iowa, said: I desire to remind the section that twelve or fifteen years ago when I, with possibly some others present, began the study of ophthalmology we had no ophthalmometer, no skiascopy, no phorometer, no homatropine, no cocaine. We had only the ophthalmoscope, the trial case, and atropine; and yet we did creditable refractive work, creditable to ourselves under modern standards and satisfactory to our patients. Now we have all the advantages and have more trouble. Is it not due to a mistaken idea of our duty, a confusion of which we ought to know, and which we ought to do (satisfactory to the patient)? Dr. Risley properly sets up the emmetropic eye as the normal eye, but an eye artificially made emmetropic will not necessarily be a satisfactory organ practically. We should know as much as possible about it and do our work within these lines. As regards mydriatics I use the mydriatic, weak or strong, according to peculiarity of the case, to secure paralysis of the accommodation. Patients complain of discomfort from disks. I find astigmatism after extraction and have used cross cylinders in some cases for the flatter field.

Dr. Chisolm said, in response to Dr. Belt's paper, that the colored race in America was only exempt from refractive errors by absence of eye tax. Prior to 1885 colored public schools in the South were very rare. Colored children up to 15 years of age were comparatively unemployed. To eat, sleep, and play, and look after the smaller children was their occupation. So that through the growing stage there was no eye tax whatever. They escaped the dangerous period of school life which starts or develops refractive trouble. Now the colored children have all the advantage of education, and the results of their new period of eye work is that they are requiring the need of glasses also, showing conclusively that it is a fault of education more than one of race. Squint in the colored race is rarely met with. In response to Dr. Wood as to the value of mydriatic disks he would say that from neutral solutions he gets all the good and prompt action that could be desired. He uses homatropine grs. vi to 1 ounce, puts a few drops into the cul-de-sac formed by drawing the lid downward, and makes a small cup as it were, requesting the patient to look downward at the same time, so as to submerge the cornea in the liquid. He secures full action of the drug in 30 to 50 minutes. In his experience the effects begin to pass away at the expiration of an hour. Rarely does he find it necessary to use the stronger mydriatics, nor has he found any especial advantage in combining them with cocaine. In answer to Dr. Savage, he does not think it necessary to paralyze completely the ciliary muscle in his refractive work and, hence protects his patients from the annoyance of atropine instillation. He makes it a rule to cover always by glasses the entire amount of astigmatism found, but does not find that patients desire to have all hyperopia covered by plus glasses. He does not succeed in keeping his patients under observation for one or two weeks. With many of them he can only retain them twenty-four hours until the action of the homatropine has passed off, and some are not seen again after the first visit. He uses homatropine in about 30 per cent of the refractive cases. When sharp answers are elicited in reference to the astigmatic charts no mydriatic need be used. When the patient is not sure of lines or angles, or when the angle differs in the two eyes homatropine instillation is used to verify the examination. In the weaker forms of simple astigmatism, when patients have acute normal vision, but can not use their eyes with comfort, he often found that an astigmatism of 0.25 D.— would be converted into one of 0.25 D. + at right angles by the mydriatic. As soon as the mydriatic effects have passed off the myopic cylinder would be accepted as the most restful glass, and that one would be pre-

scribed. In quite a number of instances he has had to change the plus cylinder, given by others under the mydriatic, and worn with no comfort, to the minus cylinder, which was immediately restful. In the mixed cases in which normal vision without the mydriatic may be reduced to $\frac{20}{200}$, showing +6+hyperopia and an astigmatism of not more than 0.25+D. When the effect of the homatropine has passed off they would need only a small part of the spherical strength with the cylinder, probably not half of it. I prescribe accordingly, and give much more comfort to patients than if I forced them to try to accustom themselves to the latent amount of error. In answer to Dr. Jackson he agrees with him fully that the extensive opening of the cornea for cataract extraction will in the healing act so change the corneal curvature as to cause more or less astigmatism. Most of this irregularity passes away in the course of time, so that glasses given at the end of a fortnight, the time that most of our cataract patients are dismissed, need changing in a few weeks or months. Dr. Love thinks that his patients escape these irregularities of the healing of the corneal wound by the peculiar manner of his eye dressing regulating the eye pressure and tightening the bandage after the third or fourth day after the operation. He has for many years considered the typical dressing of an eye after cataract extraction simply the closed lids, the cartilage of the upper lid acting as a splint for perfect adaptation of the corneal wound, held in position by the tonicity of the palpebral muscles. Formerly a piece of adhesive plaster perfected this result, and he still considers this the very best of eye dressing. In the past year he has laid this aside, as he found it interfering with the daily examinations of the eye, which he thinks the simple cataract extraction of the present day requires to reduce hernias of the iris should they occur. His present dressing is a single Lebright bandage to cover only the eye operated upon, to hold in position a thin pad of absorbent cotton, which makes no pressure. At the time that Dr. Love is tightening the bandage he himself removes it altogether, leaving the eye free and open. He bandages over five days, and has released the eye after two days' closure. He finds the astigmatism, nevertheless, neither more nor less than those who use much more manipulation and restraint than he does. He covers only the one eye operated upon, leaving the patient the use of the other. With Dr. Lautenbach Dr. Chisolm agrees fully as to the restricted value of the ophthalmometer. He had found it useful, and again very disappointing. The only concise work that he secures is by the trial lenses and astigmatic card, and we all acknowledge that they alone are reliable. He proceeds to their use at once, and only uses the other means and apparatus to aid should difficulties arise in the irregular responses of patients. With intelligent patients he rarely finds trouble; with the ignorant and timid we must use all the means at our hands for securing the best aid for them. There is no doubt that constant practice with any method of investigation will enable one to derive much more information than those who only use the method incidentally, and yet he feels assured that the few enthusiasts who profess to get everything out of the ophthalmometer of Javal, much more even than Javal himself contends for, are misleading the younger members of our body.

Dr. Hubbell, of Buffalo, N. Y., said: I think that most of us will agree that astigmatism almost always follows cataract extraction. How to make it as slight as possible is the question. My experience is that the greater the pressure from the dressing the greater the astigmatism that results. I aim simply to keep the eyelids closed without any pressure. I use a bandage consisting of a piece of flannel six inches long and two inches wide with a piece of tape three-fourths of an inch wide sewed to each end. One of the tapes is carried around the head over one ear under the occiput to the other tape as loosely as can be done and be kept in place. This is comfortable, very easily readjusted, and produces no pressure. I cover both eyes for the first four or five days, but do not restrict the freedom of the

patient. In the correction of refractive errors I combine the use of Javal's ophthalmometer, pattern of 1889, skiascopy, and the trial lenses. The trial lenses is the final resort in all patients who can read. The ophthalmometer has its drawbacks. A slight variation from the position of sharpest focalization, which is not always easy to determine exactly, correspondingly changes the readings on the minus. An error of 0.25 D. to 0.50 D. can thus be very easily made. Again, with the most accurate focal adjustment possible, the readings in the great majority of cases show greater refraction in vertical, or nearly vertical, meridians of the eye as compared with any other test, objective or subjective. This difference, also, is not a fixed quantity, but varies in different patients. In a very few cases by most careful use of the instrument I have been surprised to find the other tests placing the astigmatic meridian directly at right angles to that which it had indicated. The cases in which discrepancies are great are comparatively so few and positively misleading that I consider the ophthalmometer a most useful instrument, generally giving an approximate degree of astigmatism and a tolerably sure position of the meridians of greatest and least refraction. The shadow test is to me an invaluable objective method of examination. But this, too, has its weak points, although not as various as those of the ophthalmometer. In some patients the pupillary shadows do not move normally, so to speak. They either move instantaneously or irregularly, with or against the movement of the mirror when the glass is placed before the eye, which seems to be the nearest to the proper correction, and even without any glass, or, as in one case, which I recall, where the shadows moved normally in one eye, but in the other eye no shadow could be produced in any direction with or without any plus or minus glass, although the fundus could be distinctly seen with the ophthalmoscope and appeared normal, and the refraction nearly emmetropic. The vision in this eye was very amblyopic. I have no explanation for this anomalous response to the shadow test, although I studied the case carefully and with the eyes under the influence of homatropine. Again, the movements of the shadows when normal will sometimes indicate a spherical glass weaker and sometimes stronger than the patient will see best with by the subjective test. With normal shadows, however, the degree and direction of astigmatism can be quite accurately determined. The cases in which, with normal movements of the shadows, this method of examination gives results at variance with that by the subjective method are so very few that I rely upon it with great confidence, and it is most helpful, even indispensable, to me, in amblyopic patients and in children, and in others who can not read. The first thing I do in a case of suspected refractive error is to ascertain the acuteness of vision. If, without or with concave or convex glasses, I find vision equal five-fifths or better, I do not use the ophthalmometer, as I do not expect to find sufficient astigmatism for the readings of the instrument to aid me. But if the vision is below normal, especially if much below, in spite of spherical glasses I at once place my patient before the instrument with the expectation of getting some light as to whether astigmatism or some other condition is the cause of the reduced vision. If it shows astigmatism, this may be the cause, although there may be associated amblyopia; if it shows no astigmatism, I look for some other cause. If astigmatism is present, the direction is indicated and I can estimate its degree approximately. In short, in one moment it tells me in what direction to work. Its use takes so little time that I am always glad to avail myself of such suggestions as it may give, and I therefore use it constantly in the cases indicated. In testing for refraction I almost constantly use homatropine, 8 grains to the ounce of water. I always use it in practicing skiascopy, and generally in young people, even up to 48 years of age in cases of special importance. I instill a drop or two at intervals of three or four minutes for three or four times. I expect to get the full cycloplegic effect in twenty to forty-five minutes, when I proceed with

my examination. I do not believe longer time is necessary. I get such satisfactory results with homatropine in refractive work that it is very seldom, indeed, that I resort to atropine. I use the latter only in suspected cases of accommodative spasm, or in rare cases of apparent inability of homatropine to sufficiently suspend the accommodation. I consider it unnecessary, and therefore unjust and unfeeling, to inflict upon a patient the prolonged inconveniences and distresses of atropinization when the transient effects of homatropine serve the desired purpose. I determine the axis of astigmatism by using the single set of three parallel lines of proper size placed in the positions selected by the patient, and the degree of least and greatest refraction by finding the spherical glass which gives the best vision for such lines in corresponding positions. I then combine the cylindrical glass representing the difference in the two meridians with the proper spherical for one of the meridians and then direct the attention of the patient to the test letters. I seldom have occasion to modify the combination or the axis of the cylinder to secure the most acute vision. This method of determining the astigmatism is more rapid, and not less certain in its results, than any other which I have tried. In patients who give doubtful information or none at all, or who make contradictory statements as to how they see, the ophthalmometer gives some light and skiascopy affords most important and usually reliable aid. My practice is to correct all astigmatism, even small degrees in sensitive eyes, all of myopia, unless there is some special contraïndication, and all of the manifest and one-half to three-fourths of the latent hypermetropia, excepting the few cases which seem to require, for various reasons, a full correction, or a few others which insist, at least at first, on greater undercorrection. In all my refractive work I do not forget the changed relation between accommodation and convergence produced by wearing glasses.

Dr. Wood, of Chicago, said: There are several points elicited by the discussion of my paper which I desire to further elucidate. If it be true, and I do not think that the statements have been successfully controverted, (*a*) that solutions of the cycloplegic alkaloids in water are less effective than the same agents in oily suspension, or solid form, it must follow that homatropine disks are more effective than that drug in solution; (*b*) likewise if the effect of the ordinary alkaloids on the eye is increased by the addition of cocaine to them, homatropine plus cocaine is a more effective cycloplegic agent than the former alone; (*c*) the disk form, with cocaine, is the best one in which to exhibit homatropine when we desire to obtain its fullest effects for the determination of refractive errors. To prevent the deleterious action of the cocaine on the cornea it is absolutely essential that the eye be kept closed during the whole time that elapses between the use of the first disk and the beginning of the examination proper. The omission of this important detail is responsible for many of the failures to obtain satisfactory results with these agents. Not only is the ephithelial disturbance thus reduced to a minimum, but the scleral congestion and the foreign-body feeling and smarting shortly disappear when the eye is thus kept in a state of rest. Regarding the different effects upon the symptoms experienced in the case of hyoscyamine by Dr. Risley and myself, I can only attribute them to differences in the samples supplied by our different druggists. This alkaloid in my hands has proven so uncertain and so toxic that I have entirely dismissed it from my armamentarium as a cycloplegic.

Dr. Hiram Woods, of Baltimore, said: Refractive test for ciliary paralysis after the use of a mydriatic, which I have used for some time, is to get the best distant vision and then add a weak concave glass. Myopic refraction must be previously excluded. If the best distant vision is retained with a concave glass as strong as 0.5 to 0.75 D., I do not trust the cycloplegia. I have seen total dilatation of the pupil from homatropine, and an accommodative range left of 1 D.

Dr. Jackson, of Philadelphia, said: Some accommodation may in a few cases

remain when the refraction is quite fixed. This can only be discovered by prolonging the mydriasis. When there remains voluntary accommodation, the most valuable means of detecting it is by skiascopy. The test with lenses either at a distance or near is liable to the fallacy that one part of the pupil may have one degree of ametropia and another part may have a different degree, allowing distinct vision with different lenses, although no accommodation is present. As a mydriatic I use habitually duboisine and homatropine. The former I prescribe for use in the patient's home; the latter I always instill myself, placing a drop of the 2½ per cent solution at the upper margin of the cornea. Under these circumstances, I see failure to produce complete paralysis more frequently with the stronger mydriatic. It is extremely important that the instillation should be made effectually. With reference to postoperative astigmatism, Dr. Snellen raised the point of the influence of the position of the incision. In the cases on which my paper was based, no such influence could be determined. About one-half were cases of simple extraction with the incision in the clear cornea. One-third were cases of extraction with iridectomy with the incision in the sclero-corneal junction. The remainder were cases of iridectomy for glaucoma, the incision in the extreme periphery of the anterior chamber. They were carefully studied as to the influence of the incision and the amount of astigmatism, and gave only negative evidence. The increase of hyperopia during cicatricial contraction, referred to by Dr. Hansell, was noted in a number of cases, in one the hypermetropia rose from 7 to 11 D., the astigmatism remaining 3 D. throughout. The ophthalmometer indicates that this change is mainly due to a strengthening of the antero-posterior diameter by retraction of the cornea. High tension after iridectomy, as referred to by Dr. Kollock, must be due to jamming of a large lens into the ciliary ring, and can not affect the anterior chamber while the incision remains open.

Dr. Corr said: There are three or four points in the discussion on errors of refraction and their mode of detection and correction that it seems have not been quite fully enough dwelt upon. The first of these I will put in the form of a question: Has anyone, in books or otherwise, given a standard of relaxation of the ciliary muscle or gauge by which we may know that we have obtained the desired cycloplegic condition of the ciliary muscle as a prerequisite to determining refractive errors? Dr. Wood and all others, so far as I know, who have spoken here, have referred only to the dosage, and taken into consideration, without regard to the patient's ability to, in a greater or less degree, manage or command the use of the muscle. A moment's thought will lead you to say that this can not be so implicitly relied upon. Hence some systematic plan ought to be agreed upon by which the proper condition of the muscle may be determined. Until this is done the controversy between the relative value of homatropine and atropine will be continued. I suppose each one has established some standard or gauge for his or her self, but the trouble is they do not agree; hence our results and conclusions do not agree when they should, for we are striving for the same thing amid conditions that are very similar. I will not impose on you details of varying procedure, but give my gauge or standard. After running over the case in a superficial way so as to determine the V. and the accommodative power, determining finest print the patient can read, I begin my dosage, usually homatropine 1 per cent solution, which I instill a drop every five or ten minutes for three times or oftener, after which I wait a variable time, half to one hour; then I present him a card with grades of fine print. While the patient could read medium or fine print before, he will usually say: "I can't read any on the card." Then I take a 2½ or 3 D. lens and place before his eyes, when, if that or a stronger lens only enables him to read as he read before mydriasis, I conclude that the muscle is fully relaxed. From this as a standard or gauge, I proceed to determine the error of refraction. The next point is the one of so-called "mixed astigmatism." I agree with all who may assert

it, that there are many cases of apparent mixed astigmatism, but I have never met with a case that did not, under proper mydriasis, restore itself into some simple variety or compound variety of astigmatism. The third point is the one referred to by Dr. Chisolm; that of prescribing minus cylinders axis horizontal in cases of hypermetropic astigmatism. I suspect these are the cases of mixed astigmatism referred to, and involves the question as to whether you would prescribe a minus cylinder axis horizontal in a case where there is simple hyperopic astigmatism in horizontal meridian. Another point that I think should be emphasized more definitely is that, according to circumstance, of requiring the patient to wear a full correction. I think this ought to be insisted upon in many cases as importunately as is agreeable. As is well known, the distant vision is not so good for a variable length of time with the full correction. Of this the patient ought to be advised, that the medicine must be taken for awhile, bad as it is, and soon it will taste better. Here another point suggests itself, that of whether we should lead our patients to expect a cure of their eye discomfort, or headache, or whatever led them to seek advice except amblyopia, so they will not always need to wear the correction. I have seen cases of perpetual and torturing headache for many years so far cured that they could leave off the correction, still pursuing their studies or business with immunity for years.

Dr. Savage, of Nashvillee, Tenn., said: My advocacy of the complete suspension of the accommodation of the operator, as well as of the patient. A full knowledge of the error should be had, not that in all cases a full correction should be given, but that a correct record should be made. The "balance" of the lateral muscles should determine if no correction, a partial, or a complete correction of the focal error is to be made. And let me insist that these cases be tested when the eyes are uninfluenced by the mydriatic. As to the correction of astigmatism, this can be done in any case by either plus or minus cylinders, the one increasing the refraction of the least refractive meridian, the other decreasing the refraction of the greatest refractive meridian, and in either case the astigmatism is corrected. Knowing the existence of a lateral muscle error, but ignoring its treatment, we should be guided by this knowledge in prescribing plus or minus cylinders. If there is hypermetropic astigmatism associated with exophoria a minus cylinder correcting the astigmatism would add to the patient's comfort, while a plus cylinder would increase his discomfort. If the hypermetropic astigmatism should be associated with esophoria it would be folly to correct the astigmatism with a minus cylinder, for it would make the patient worse. The correct thing to do would be to treat the muscle error and cure it, either by operation or exercise, and then prescribe the lenses indicated by the state of the refraction. I am asked if a mydriatic is not necessary in our study of cases of mixed astigmatism? It is, but not more so than in the other forms of astigmatism. We may have a case appearing to be mixed astigmatism, which the mydriatic will show to be hypermetropic, simple or compound. On the other hand, we may have a case of apparently myopic astigmatism, simple or compound, which the mydriatic would show to be mixed astigmatism. Mixed astigmatism is so rare that a man's reputation may suffer who fails to find it when it exists, or supposes he has found it when it does not exist. The mydriatic can alone make him certain. If he should find it he should tell the patient of it; and if he does not give the mixed correction he should give his reasons to the patient. Otherwise when the patient drifts into the hands of some confrère, he may remark: "I have always considered Dr. —— a competent man, but he missed it badly in your case." It is always best to know the refractive error and to correct it, or give the patient some good reason for not prescribing a full correction. To the question just asked by Dr. Corr, "Do glasses scientifically prescribed relieve the symptoms, headaches, etc., commonly attributed to eye strain," I will answer by reporting a case that has come under my observation. The patient not only suffered

with headache but was also an epileptic. I was asked by the physician in charge of the case to examine the eyes and correct any error found, with the hope of a cure. It was agreed that the patient should not be told that we suspected that anything like a causative relation existed between the eyes and the epileptic attacks. I found 4.50 D. hypermetropia in one eye and 5 D. in the other, with slight astigmatism in each. This was seven years ago, when I was not a believer in muscle troubles, hence did not then know that this patient had an esophoria. I fortunately prescribed a full correction. The glasses were worn more or less continuously four years, with relief from headaches and epileptic seizures. Not having been impressed that the glasses had brought this relief, the patient began to leave them off, and finally ceased wearing them. The epilepsy returned and, strange to say, the glasses were still neglected. Four months ago the new family physician in getting a history of the case, learned of the wearing of the glasses and the coincident immunity from suffering. He sent the case to me for investigation again. I did not reëxamine the focal condition. Having in the meantime learned something of heterophoria (thanks to Dr. Stevens who made this study a possibility, and thanks to my good fortune that I stumbled into this study even as early as I did), on investigation I found 4 degrees of esophoria about the same for near and distant vision. On placing the full focal correction before the eyes I found that both the focal and the muscular error was corrected by them. This I expected from my knowledge of the relationship between the centers of accommodation and convergence. For the first time I told the patient that the epilepsy was due to errors of the visual apparatus which the glasses corrected; and I gave assurance, based on four years of relief by wearing the glasses, that these would cure in that they would remove the cause. There have been no other attacks nor do I expect any so long as the glasses are worn.

Dr. P. Lagleyze, replying to Dr. Savage, said: Algunos oculistas emplean indiferentemente los midriáticos para la corrección de cualquier vicio de refracción. El diámetro de la pupila ejerce una acción considerable sobre la agudeza visual, porque las dimensiones de los círculos de difusión están en relación directa con el grado de dilatación pupilar.

El diámetro de la pupila no influiría mucho sobre la nitidez de la imágen, á pesar de la aberración de esfericidad y de refrangibilidad que poseen todos los ojos, si la córnea fuera esférica. La córnea tiene una forma elipsoidal y según las últimas medidas practicadas por Sulzer, resulta que si se pasa del centro á la periferie, la curvatura disminuye irregularmente, no solo á lo largo de los dos meridianos principales, sino aún á lo largo de las dos mitades del mismo meridiano. Esta disposición es causa de diferencias entre la refracción central y la de las partes periféricas. Se concibe, pues, que la atropina, permitiendo que las partes periféricas de la córnea participen en la visión, produzca variaciones, y por consiguiente que el vidrio corrector elegido en estas condiciones no sea el más conveniente.

En los hipermétropes, en general, no debe recetarse lentes bajo la acción de la atropina; el hipermétrope, por el hábito de acomodar constantemente ha establecido una armonía difícil de alterar entre su convergencia y su acomodación, empleando una parte ó toda su amplitud relativa de acomodación positiva binocular.

Sin embargo, no debe desecharse en absoluto el uso de los midriáticos; hay casos, en que llena una indicación, por ejemplo, cuando se sospecha una contracción irregular de la acomodación y tambien en los espasmos ciliares de todo el músculo.

Some oculists employ indifferently mydriatics for the correction of any vice of refraction. The diameter of the pupil exercises considerable action on the visual sharpness, because the dimensions of the circle of diffusion are in direct relation with the degree of dilatation. The diameter of the pupil would not influence much the clearness of the image, notwithstanding the spherical and refractive observation that all eyes possess, if the cornea was spherical. The cornea has an ellip-

soidal form, and according to the latest measurements practiced by Sulzer, it results that if it passes from the center to the surface the curvature diminishes irregularly, not only in length of two principal meridians, but also in the two halves of the same meridians. This arrangement causes the difference between the central refraction and that of the peripheral parts. We conceive, then, that atropine, allowing that the peripheral parts of the cornea participate in the vision, produce the variation and therefore that the correcting glass selected in these conditions is not the most convenient. In hypermetropia in general, glasses must not be prescribed when under atropine influence. The hypermetropia, by the habit of constantly accommodating has established a harmony difficult to change between its convergency and accommodation, employing a part or the whole of its relative ampleness for positive binocular accommodation. Yet, the use of mydriatics must not be put aside absolutely. There are cases, for example, when an indication has been filled, when we suspect an irregular contraction of accommodation and also in ciliary spasm of the whole muscle.

Dr. Belt, of Washington, D. C., said: In reference to Dr. Jackson's paper on astigmatism following cataract extraction, I am inclined to think that a large amount of astigmatism is due in our prescribing glasses and allowing the use of the eyes for reading too soon after the extraction. The patient having been blind for some time is impatient to see to read and work, and wants his glasses as soon as possible, and when he gets them he thinks he should be able to read with as great facility as ever, and when he finds he can not do that, by great effort tries to bring to his aid the external muscles and lids, and this great pressure on an eyeball, still weak and pliable when the corneal section was made, cause the astigmatism. This is probably counteracted later by contraction of the wound by cicatrization, thus decreasing the astigmatism. However, astigmatism may develop a year or two after extraction; e. g., in a case operated upon by me about two years ago, three months after extraction vision was $\frac{20}{30}$ with 10 D., three months later a 1 D. cyl. ax. 180° was required to give that vision, and a year later a 2 D. cyl. ax. 180° was required. In reference to the disks of homatropine and cocaine as recommended by Dr. Wood, I tried disks of homatropine, thinking they would be convenient for the patient to use an hour before coming to my office so I could proceed at once with the examination, but usually found as a result conjuctival irritation sufficient to interfere with the examination, so I have gone back to the use of solutions. I think the combination with cocaine objectionable, owing to its causing dryness of the epithelium, which prevents clear perception. Dr. Kollock called attention to the cases of corneal disease found by me among the colored pupils. Knowing its prevalence generally in the race, I can only account for it by the carelessness of negro parents in allowing children, even with slight troubles, to remain at home. I did not pay especial attention to the question of whether the cases of strabismus found in the colored pupils were among the mulattoes or the pure-blooded negroes.

Dr. Chisolm said: To-day we take up the subject of muscle errors. We have been a long time finding out that the extraocular muscles, numerous and large as they are, should necessarily play a very important rôle in the comfort and discomfort of eye work. I can not say that we have devoted too much time to the study of refractive errors, for ciliary muscle action is undoubtedly the pivot for acute. But to keep the fovea centralis in its proper place, to secure binocular vision, is the duty of the recti and oblique muscles. It requires that these six pairs of muscles be nicely adjusted and always alert, for they are in perpetual action during our wakeful hours. Lately I have been devoting much more time in exploring the individual functions of each of these muscles, and am quite sure that results are against my former neglect. I hope that the discussion will elicit much knowledge for our future guidance in a class of cases which becomes quite numerous the more carefully we seek them.

A CLINICAL STUDY OF HETEROPHORIA.

By Dr. HIRAM WOODS, of Baltimore, Md.

I fear my paper may seem to some surgeons too elementary; reactionary rather than progressive. Most of the articles one meets nowadays in journal literature on heterophoria show, it seems to me, a tendency toward a refinement of diagnosis and treatment, proper enough in itself and under certain circumstances, but not reaching the question which daily puzzles an oculist in office work. "What is the significance of the heterophoria in the case before him?" Text-books of eight or ten years ago give little or no information. Those by American authors of more recent date discuss the subject more or less fully; but I doubt if Dr. Noyes, or Dr. de Schweinitz, or other recent book writers, would claim that their chapters on muscularas thenopia are more than pointers for original investigation. The more I see of heterophoria the more I appreciate the truth of a recent remark by Dr. Stevens (Ophthalmic Record, January, 1892): "One will find himself too often in the face of serious embarrassments to believe that he has arrived at the knowledge of an easy system in which all the ultimate facts are at his command." I am often in doubt whether to lay stress upon the refraction and accommodation or upon the muscular anomaly; whether to regard the latter as really the cause of the asthenopia headache or other disturbance which has brought my patient to me, or as only symptomatic and secondary, a guide, so to speak, to the real cause. This question lies at the bottom of every case. It can not be answered by the amount of equilibrium error; for, if my experience has taught me correctly, fractional degrees sometimes cause trouble, and high grades frequently do not. I wish to present in this paper a few clinical observations in the hope that they may call from those better acquainted with the subject a profitable discussion. I have nothing new to offer; only a study of the findings by methods in common use.

For four or five years I have realized the importance of examining the condition of the extrinsic eye muscles. Cases of asthenopia I could not relieve, no matter how carefully I corrected the refraction. I consulted others with the same result. I first turned my attention to the subject in a practical way. I began work by causing diplopia at 20 feet by holding a square prism in front of the eye. For two years or more I have used Maddox's double prism, with a colored glass before one eye, and more recently his rod. Before examining the muscles, I correct the refraction, giving as nearly the full correction as is consistent with the best visual acuity. I note abduction. If the equilibrium test has shown orthophoria and abduction is 10 or 12 , I suspect "latent" exophoria, as it has been called. If it is below 5°, I suspect "latent" esophoria. I am skeptical about adduction. In the first place, as has been pointed out by others, it is a distance test only so far as convergence can act independently of accommodation: i. e., to the extent of the positive portion of the relative range of convergence for infirmity, Dr. Randall (Trans. Am. Ophth. Soc., 1889) says: "Adduction can be made almost anything, if the patient and examiner have patience." It is striking how rapidly adduction increases as soon as the patient learns how to fuse images of unequal clearness. I have seen adduction of 48 , while the balance test showed exophoria of 10 . Its determination is not, in my opinion, important unless one is contemplating an internal tenotomy for esophoria, when it is well to know that adduction can be developed to a point higher than the normal relation to abduction.—7 or 8 to 1.

Unless the equilibrium test has shown hyperphoria, I do not, as a rule, examine the power of the vertical muscles to overcome opposing prisms. I look upon comparison of the distance and near equilibrium as very important. Except in the case of presbyopia, or where there are, in myopia, conditions which demand special modification of the glass for near work, the near test should be made with distance glasses. What relation should the near equilibrium bear to the distance?

Dr. Noyes (*loc. cit.*) says that "most commonly there is a deviation (from the vertical) in the sense of abduction of about 5° which can not be called abnormal." Dr. Randall (*loc. cit.*) thinks that insufficiency of convergence for the near is the rule among hypermetropes, because the hypermetrope can avoid excessive convergence only by utilizing and developing the negative part of his range of relative convergence and * * * the correction is overdone." Again, two years later before the same society, in discussing a paper of Dr. Theobald's, he said that while this convergence insufficiency at the near was the rule rather than the exception, he could not accept it as normal any more than he could "accept as normal the hypermetropia which is present in the majority of eyes." As to the frequency of this near divergence, compared to the distance balance, 100 consecutive cases from my case book show: Equilibrium the same at 13 inches as at 20 feet, 16; comparative divergence at 13 inches, 81; comparative convergence at 13 inches, 3; total, 100.

The distance equilibrium of the 100 was, orthophoria, 39; esophoria, 29; exophoria, 28; hyperphoria, 3; hyper-exophoria, 1. This condition was noted in 23 of the 39 with distance orthophoria; 26 of the 29 with esophoria; all the 28 with exophoria; and the 4 with vertical deviation. I do not think another 100 would differ materially from this. It is clear that the condition is so very frequent as to be almost constant, and is not confined to any form of distance equilibrium. Regarding the associated refraction of these 82 cases, 54 were hypermetropic; an apparent confirmation of Dr. Randall's statement that it occurs most frequently in hypermetropic refraction. Myopic refraction was noted in 21 of the 82, with near divergence. Of the entire number (100) 66 showed hypermetropic and 26 myopic refraction. Thus a divergence at 13 inches, relative to the equilibrium at 20 feet, was noted in 81.8 per cent of persons with hypermetropic and 80.8 per cent of persons with myopic refraction, a difference of 1 per cent only. These figures would seem to indicate that divergence at 13 inches is seen most frequently in hypermetropia, because hypermetropia is the most common form of refractive error. Is this divergence at the near compared to the balance at 20 feet normal? Can we make any useful inference from a departure from it? In my opinion we can, and I daily use it as a guide in my refraction work.

Dr. Samuel Theobald presented a paper to the American Ophthalmological Society in 1891, entitled: "Subnormal accommodative power in young persons a not infrequent cause of asthenopia." The objective point of the paper was to show that young persons often became asthenopic without refractive or muscular error; that others continued so after the correction of these errors, and that the cause lay in a subnormal accommodative power, whether a weak ciliary muscle or a lens incapable for one reason or another of responding to ciliary action. It was pointed out that the usual symptoms of presbyopia did not exist in this condition, but that the diagnosis lay in the relation of the equilibrium test at 13 inches to that at 20 feet. He looked upon a comparative divergence at 13 inches of 2° to 5° as normal. The near balance might depart from this in the direction of excessive or deficient divergence. Excessive divergence might come from myopia through the correlation of the functions of accommodation and convergence. Dr. Theobald thought that low exophoria which appeared as orthophoria at 20 feet could cause the same excessive divergence at 13 inches. The exclusion of this, I think, would be very easy. There are cases of exophoria which for a time appear as distance orthophoria, but they generally are accompanied by abduction of 10° to 12° or the retention of the orthophoria balance at 20 feet with an abducting prism. The third cause of comparative divergence over 5° was a hypersthenic ciliary muscle, calling for less nerve force, and so causing less nerve force to the internal rectus. Departure from this "normal" comparative divergence of 2° to 5° in the direction of deficient divergence could come from any condition which might call for excessive nerve stimulation to the ciliary and so to the internal

rectus muscle. Uncorrected hypermetropia, a weak ciliary muscle, or an unresponsive lens, demanding more than normal ciliary action, are such conditions. Hypermetropia can easily be excluded. Esophoria, by lessening the amount of opposition to the interni, might also cause it; but if the esophoria is not disclosed by the equilibrium test at 20 feet low abduction or the retention of orthophoria with an adducting prism would lead us to suspect it. Thus we are left with the subnormal accommodative power. The conclusions drawn by Dr. Theobald are (1) comparative divergence at 13 inches of 2° to 5° is normal; (2) in the absence of the other possible causes, which can be excluded, a comparative divergence greater than 5° means hypersthenia of the ciliary muscle, less than 5 subnormal accommodative power.

A word concerning this near test as modified by refraction correction. (1) The relation holds only when the near test is made with the eyes behind the same glasses worn during the distance test. In compound hypermetropic astigmatism, for instance, after mydriasis has disappeared the hypermetropia often becomes latent, the cylinder alone being accepted. The addition of a spherical, correcting any part of the latent hypermetropia, increases the comparative divergence. A case in point:

March, 1893; Mrs. C., 22 years old; eye pains and headache on reading. Under homatropine right eye attained $\frac{20}{20}$ with + 1.5 S.; left eye attained $\frac{20}{20}$ with + 1.25 S. ⊂ + 0.75 C. 90°. Three days later right eye, Hm. + 0.75 $\frac{20}{20}$; left eye, As. Hm. + 0.75 C. 90° $\frac{20}{20}$; muscle 20 feet, esophoria, 3°, Ab., 5°, near esophoria, 3°; no comparative divergence at all at 13 inches. By adding the spherical equivalent to the latent H., near orthophoria was obtained, but distant vision was reduced to $\frac{20}{40}$.

A message from this lady two weeks ago was to the effect that these glasses had completely relieved her. My reason for neglecting the esophoria in treatment was the nearly normal abduction (5°). I felt reasonably sure that it was secondary to the uncorrected refraction error, which was of such a nature as to cause excessive internal rectus action. In this comparative divergence I find a guide to the correction of latent hypermetropia. I believe that the nearer we come in our refraction work to an emmetropic correction, the more positive and permanent will be the relief. But the correction of latent hypermetropia often relieves distant vision, and, in *low* compound hypermetropic astigmatism, especially, the correction of the astigmatism alone frequently relieves. While these are exceptions, I believe a safe rule is to correct enough latent hypermetropia to produce at 13 inches a comparative divergence if 2° or 3°.

(2) In myopia of 3 or 4 D., if the correcting distance glass be employed at 13 inches, there will nearly always be deficient comparative divergence, disappearing when the strength of the concave is reduced. I believe this is due to the habitual non-use of the ciliary muscle.

I have for the past two or three years been in the habit of training young myopes with normal visual acuity and good fundus to wear their total correction, provided it does not exceed 5 or 6 diopters. Reading for a time is difficult, but the ciliary muscle soon learns to work, and the usual comparative divergence at 13 inches develops. Esophoria contraindicates the use of the strong concaves for near, I think, because of the necessarily increased ciliary, and so internal rectus activity. But esophoria and myopia of any degree are not frequently associated.

I have dwelt thus at length upon the relation of the near to distance equilibrium because I am inclined to think there is a tendency to underrate the value of the near test. It is useless as a test for muscular equilibrium; but if its relation to the distance balance has such significance as Dr. Theobald has given it it is useful not only as a diagnostic sign of subnormal accommodative power, but as a guide in the treatment of at least one form of heterophoria, viz, esophoria. If this condition occurs, as it usually does, with hypermetropic refraction, the indication would be to correct all or nearly all of the hypermetropia, and the more nearly the 13

inches balance corresponds with that at 20 feet the more of the hypermetropia should be corrected. I have already spoken of esophoria contraindicating strong concaves at the near. When there is no refractive error, and the esophoria is to be attacked independently, an excess of near divergence indicates a weaker adducting prism than if the comparative divergence is of the usual degree or deficient. In esophoria, prisms, according to my experience, give us their best results, and this guide to regulating their strength is with me not a mere theory. Contradictory findings by the various tests are a common cause of perplexity.

Different results may be gotten at different sittings: the equilibrium tests and the power of the muscles to overcome opposing prisms may not harmonize. Such things Dr. Stevens has attributed to hyperphoria. That this variety of heterophoria does influence the others can not be doubted. I want to mention two or three cases, however, which show, I think, how close the connection is between anomalies of the ciliary muscle and anomalous heterophoria.

Mr. G., 28 years old, consulted me in April, 1890. He was unable to work comfortably at his desk in the post-office. He was wearing — 0.25 C. 180 with $\frac{20}{15}$ D. V. He rejected all convex glasses. He had orthophoria at 20 feet with ab. of 12°. A near test was not made at that time. Under atropine his apparent low M. As. was turned into compound H. As., each eye accepting +1 S. ⊃ +0.5 C. 90°. As mydriasis wore off, convex glasses reduced vision to about $\frac{20}{40}$. Minus cylinders at once cleared vision, but he found he could work better with the convex glasses. For a year or so he called to see me occasionally. He always had orthophoria and high abduction 10 to 12°. He gradually got $\frac{20}{20}$ with his glasses and still more gradually developed an exophoria, which in the end amounted to 6°. He has since then worn prisms 2°, bows in, combined with his refraction correction, and is comfortable.

This seems to me to be a case of exophoria concealed by an excessive innervation of the weak muscle, associated with ciliary spasm. An abduction too high for the equilibrium was the only indication. The exophoria was, I believe, a factor in producing the ciliary spasm. My assistant at the Presbyterian Hospital called my attention a few months ago to the case of a seamstress 23 years old who had had only $\frac{15}{40}$ V. when he first examined her. Improved by minus glasses. Homatropine gave her $\frac{15}{30}$, and atropine, used for several days, had brought her to $\frac{15}{15}$ with a +0.75 S. The girl had persistent headaches and the refraction did not account for either them or this ciliary condition. The equilibrium test at 15 feet showed exophoria of 9° with abduction of 10°. The explanation seemed clear: exophoria with secondary ciliary spasm. I have seen several such cases as these, but it is useless to narrate them.

The points I desire to make are that a contradiction between equilibrium and abduction requires careful investigation; that a weak internal rectus may produce ciliary trouble, and this contradiction be the only clue to the real cause. Neither of these cases had any manifest or latent vertical deviation.

A second anomalous finding I have met at 20 feet is exophoria, with normal abduction.

Mr. W., 22 years old, student, was first seen in 1887. He was unable to work over half an hour without pain. Glasses had so far failed to relieve him, though selected by a competent man. His refraction under atropine was, right eye, $\frac{20}{20}$, with — 2.25 ⊃ — 0.5 C. 45°; left eye, $\frac{20}{20}$, with — 4 S. ⊃ — 0.75 C. 180°. The muscle test at 20 feet was exophoria 4°, ab. 6°, ad. 24°; at 13 inches, exophoria 4°, same as at 20 feet. The amplitude of accommodation was only 2.5 diopters. He was given the full correction for the right eye for distance, with the same spherical correction over the astigmatism for his left. On account of his weak accommodation, only the cylinder was ordered for his best eye (the right), the cylinder and — 0.75 S. for left. He read at 13 inches with these, either eye. For a time he was better, and then the old symptoms returned. Not to prolong the case, after two years' of tonic, electric, and other time-wasting methods of treatment, advised by myself and others, it was decided to get rid of the exophoria. I did external tenotomy. At first an esophoria of 3° resulted, but in a few days orthophoria was found. The therapeutic results were absolutely nil. Work over 15 minutes was an impossibility. In a year (1890) there was the old muscular condition.

At my suggestion Mr. W. went to New York in the fall of 1890 and consulted Dr. David Webster. Dr. Webster expressed the opinion that everything had been tried except to make the accommodation work. He advised full correction on both eyes for all work. Mr. W. put on his glasses, and for nearly two months held his reading (when he did any) at arm's length. His discomfort was greater than ever. Still he persevered, and gradually his p. p. came within respectable limits. His condition now is, to use his own words, "as good as it probably will ever be." He can read and write for several hours, and follows his occupation of civil engineer. His exophoria has disappeared at 20 feet and his abduction is 6° at 13 inches; he has 1° to 2° of exophoria. Here, it seems to me, was a case of weak ciliary muscles. Because of the myopia they did not receive the extra nerve force spoken of, and so the internal recti did not receive it either. The result was pseudo-exophoria, and the normal abduction should have been a clue.

A third anomalous finding at 20 feet, which I have noticed in connection with hypermetropic astigmations, especially against the rule, is esophoria with normal or even high abduction. Time will not allow me to cite the cases in detail. Suffice it to say that they usually show deficient comparative divergence at 13 inches, and that the esophoria nearly always disappears after the correcting cylinders have been worn for a time. Their explanation is to be found, I believe, in the excessive and irregular action of the ciliary muscle called out by the uncorrected refractive error.

I would not be understood as expressing a doubt that all kinds of heterophoria can cause distressing asthemopia; that even when refraction errors exist, the muscular error may be the most important element. I have had, myself, a personal experience with esophoria, and know how to appreciate the value of adducting prisms, and later, the internal tenotomy which my friend, or Harlan, did for me last March. But in the cases such as I have narrated, where one test contradicts another, I believe it behooves us to move slowly; to find the underlying cause by patient, repeated investigations before we put on prisms, except for diagnosis; proceed with exercise, or do tenotomy. I believe this cause is found in the accommodation or the associated refraction error more commonly than is generally thought, and that frequently muscular perplexities will clear up behind spherical or cylindrical glasses. When there is nothing found of importance except the muscular error, it is foolish to delay. I should like to discuss some other points, but I can do nothing more than mention them. I have not met hyperphoria as often as some others seem to meet it, but I have seldom seen it exist to the extent of 1½° or 2° without requiring treatment. I have had in a few patients to correct, by prisms, as little as ½° or ¾°, and with good results, after refraction correction had failed to relieve. Again, I believe there is a good deal in the association of certain refraction errors and different forms of heterophoria. Hypermetropia and exophoria, myopia and esophoria, low degrees of heterophoria and astigmatism against the rule, have seemed to me specially troublesome combinations.

There are certain symptoms which I think characteristic of muscular asthenopia. They are mentioned in Dr. Noyes's book, and in my own case I have noted them, I am sorry to say, in an emphatic way, a sense of tension while reading, occasional paroxysms of pain in the eyeballs, lasting sometimes two or three hours, pain on awakening in the morning, and an indefinite, but, as I know by experience, positive symptom which a gentleman a short time ago thus described to me: "My eyes just won't work any more," i. e., a sudden collapse while at work. Such symptoms, I believe, are usually due to the muscular anomaly.

To review the entire subject of heterophoria in one paper is an impossibility, and I must leave the question of treatment almost untouched. By exercising the weak muscles with prisms I have gotten good results in a few cases of exophoria, but in the other forms of heterophoria I have found it useless. I am now trying Dr. Savage's "rhythmical exercise," but can not yet say much about it. Prisms have

given me best results in esophoria and very low degrees of hyperphoria. I have never done tenotomy for less than 6° of esophoria, 4° of exophoria, and 2° of hyperphoria. I have always done complete tenotomy. The operation, in some instances, where the error was low, was undertaken only after other treatment had failed. It was "complete" only because repeated examinations during the "partial" stage failed to show any equilibrium gain. I know it is behind the times to say so, but I have never noted any change in the equilibrium test at 20 feet until I thought I had severed the entire tendon. I meet cases in practice where prisms are not tolerated. Evidently the muscular anomaly is causing the trouble, and I know there is not room for a complete tenotomy. I hope to get some light on this question to-day.

AN ANALYSIS OF FIFTY SUCCESSIVE CASES OF INTERNAL SQUINT.

By HOWARD F. HANSELL, M. D.,

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TABLE OF CASES.

No.	Sex.	Age.	Age when noticed.	Fixing eye.	Refraction (under myd.) of right.	Refraction (under myd.) of left.	Vision of right.	Vision of left.
1	F.	17	3½	L.	+ 4 ⊂ + 2 c. ax. 90°	+ 4 ⊂ + 1.75 c. ax. 90°	6/60	7/50
2	F.	25	12	R.	+ 1 ⊂ + 3 c. ax. 80°	+ 1 ⊂ + 3 c. ax. 100°	6/6	1/15
3	F.	23	3½	R.	+ 3	+ 5 (estimated)	6/6	6/6
4	F.	8	1½	L.	+ 4 ⊂ + 1 c. ax. 135°	+ 4 ⊂ + 1 c. ax. 45°	6/6	6/60
5	F.	3½	(1)	R.	+ 2	+ 2	7/50	7/50
6	M.	45	(3)	R.	+ .25 ⊂ + .50 c. ax. 90°	+ 3 (estimated)	(2)	(2)
7	M.	22	4	L.	+ 1.75 ⊂ + 3 c. ax. 70°	+ 3 ⊂ + 1 c. ax. 110°	6/6	1/60
8	F.	13	3	L.	+ 3	+ 3.25 ⊂ + .25 c. ax. 90°	6/60	6/6
9	M.	14	4	R.	+ 1.25 ⊂ + .25 c. ax. 90°	+ 1.25 ⊂ + .25 c. ax. 90°	6/6	6/6
10	M.	10	6	R.	+ 3 ⊂ + 3 c. ax. 80°	+ 3 (estimated)	6/6	6/6
11	F.	6	3	R.	+ 1.25 ⊂ + .50 c. ax. 90°	Irregular astig	6/12	6/6
12	F.	6	2	R.	+ 2.50	+ 2.50	7/50	6/6
13	F.	4	3	R.	+ 2	+ 2	6/18	6/15
14	F.	15	6	R.	+ 4 ⊂ + 2.25 c. ax. 180°	+ 4 ⊂ + 1.25 c. ax. 135°	7/50	7/50
15	M.	7½	6	R. or L.	+ 4 ⊂ + 1 c. ax. 45°	+ 4.75	6/6	20/+
16	M.	8	(1)	R.	+ 3.50	+ 6	6/10	6/10
17	F.	9	2	R. or L.	+ 4 ⊂ + 2 c. ax. 100°	+ 4 ⊂ + 2 c. ax. 90°	6/6	6/10
18	F.	8	2	R. or L.	+ 2.50 ⊂ + .50 c. ax. 90°	+ 2.50 ⊂ + .50 c. ax. 90°	7/50	7/50
19	F.	17	6	R.	+ 5 ⊂ + 1.25 c. ax. 90°	+ 5 ⊂ + 1.25 c. ax. 90°	7/50	7/50
20	F.	10	(2)	R. or L.	— .50 ⊂ — .25 c. ax. 180°	— .50 ⊂ — .25 c. ax. 180°	7/50	6/30
21	M.	9	(2)	R. or L.	+ 1 ⊂ .25 c. ax. 90°	+ 1 ⊂ .25 c. ax. 90°	6/6	6/6
22	F.	18	3	R.	+ 1 ⊂ + 1 c. ax. 90°	+ 2 (estimated)	6/6	6/6
23	M.	15	4	L.	+ 6 ⊂ + 2 c. ax. 135°	+ 7 ⊂ + 1 c. ax. 180°	6/6	6/60
24	M.	4½	2	R.	+ 5.50 ⊂ 1 c. ax. 90°	+ 5	1/15	7/50
25	F.	40	(2)	R. or L.	— .25 ⊂ — .50 c. ax. 135	.25 ⊂ .50 c. ax. 15	(4)	(4)
26	M.	38	(2)	R. or L.	+ 5.50 ⊂ + .50 c. ax. 75°	+ 5.50 ⊂ + .50 c. ax. 75°	6/6	6/6
27	M.	27	(3)	L.	+ As	+ As	6/6	6/6
28	F.	20	4	R. or L.	+ 3 ⊂ + .75 c. ax. 45°	+ 2.25	1/12	7/50
29	M.	25	(2)	R.	+ 1.75	+ 2	6/6	6/6
30	M.	25	(2)	R. or L.	+ .50 ⊂ + 2.50 c. ax. 110°	+ .50 ⊂ + 2.75 c. ax. 80°	7/50	7/50
31	F.	19	3	R.	+ 2.25	3.50	6/6	6/60
32	M.	28	3	R.	+ 4 ⊂ + 3 c. ax. 75°	+ 4 ⊂ + 4 c. ax. 90°	6/6	6/60
33	F.	9	5	L.	+ 1.75	+ 1.75	1/10	6/6
34	M.	25	(2)	R.	+ 4 ⊂ + 1.50 c. ax. 90°	+ 4 (estimated)	6/6	6/6
35	F.	28	(2)	L.	+ .75 ⊂ + 1.50 c. ax. 45°	+ .75 ⊂ + 1.75 c. ax. 135°	1/6	1/8 +
36	F.	8	2	L.	+ 5.50	+ 7	6/6	6/6
37	F.	12	(1)	L.	+ 4.50	+ 3.50	6/6	6/6
38	F.	6	2	L.	+ 3	+ 3	6/60	6/6
39	M.	36	(2)	R. or L.	+ 4 ⊂ + 2 c. ax. 130°	+ 3 ⊂ + 2.50 c. ax. 115°	7/50	7/50
40	M.	19	(2)	L.	— 6	+ 1	6/60	1/12
41	F.	13	(2)	L.	+ 3 ⊂ + 2.50 c. ax. 120°	+ 2 ⊂ + 1 c. ax. 60°	6/6	6/6
42	M.	34	(1)	L.	+ .25 ⊂ — 1.25 c. ax. 120°	— 1.50 c. ax. 75°	1/20	6/6
43	F.	14	4	L.	+ 2.50 ⊂ + 3 c. ax. 20°	+ 3.50 ⊂ + .50 c. ax. 180°	1/12	1/12
44	F.	11	(2)	R. or L.	+ 5 ⊂ + 1 c. ax. 45°	+ 4.50 ⊂ + .50 c. ax. 135°	1/8	6/6
45	F.	8	1	L.	— 1	+ 2	(2)	(2)
46	F.	5	2	R.	+ 2.50	+ 3	6/6	6/6
47	F.	30	(3)	R.	+ 4.50 ⊂ + 1.50 c. ax. 30°	+ 4.50 ⊂ + 1 c. ax. 150°	6/6	1/12
48	F.	36	(2)	L.	+ 2.50 ⊂ + .50 c. ax. 97½	+ 2.25 ⊂ + .50 c. ax. 90°	7/50	6/6
49	M.	25	(2)	R. or L.	+ 1.25 ⊂ + .25 c. ax. 180°	+ 1 ⊂ + .25 c. ax. 135°	6/6	6/6
50	M.	7	6½	L.	+ 4 ⊂ + .50 c. ax. 90°	+ 4	6/18	1/15

[1] Birth. [2] Unknown. [3] Childhood. [4] Illiterate.

Inspection of the series of cases shows:

1. That convergent strabismus is most common between 2 and 4 years of age (36 per cent). The earliest age at which it was noticed was at birth (4) and the latest at 15 years (1).

2. Females preponderate over males as 31 to 19.

3. The right was the fixing eye in 20, the left in 18, and either eye was used indifferently in 12 cases.

4. The refraction was hypermetropia in 92 eyes; 2 had myopia, probably acquired through corneal inflammation; 4 had comp. M. As., with full acuity of V.; 2 had hyperopic astig. with one-half V. The fixing eye showed simple H. in 16; comp. H. in 21 cases. Of the former H. was less than 2 D. in 3; between 2 and 4 in 10; between 4 and 6 in 2, and above 6 in 1 case. Of the latter the comp. H. As. was less than 2 D. in 4; between 2 and 4 in 7, and higher than 4 in 10; defect unrecorded in 1. The squinting eye showed simple H. in 18, comp. H. As. in 15. The former H. was less than 2 D. in 1; between 2 and 4 in 12; higher than 4 in 5. Of the latter comp. H. was less than 2 D. in 1; between 2 and 4 in 2; higher than 4 in 12. Twelve cases used either eye indifferently for fixation; of these there was no case of simple H. in both eyes; 2 had comp. M. As. of low degree; 3 had comp. H. As. of less than 2 D.; 3 between 2 D. and D., and 4 between 4 D. and 6 D.

5. Vision in the fixing eye after correction equaled 1 in 21, $\frac{2}{3}$ in 9, $\frac{1}{2}$ in 4, and $\frac{1}{3}$ in 2 cases; unknown in 2. V. in the squinting eye after correction equaled 1 in 2, $\frac{2}{3}$ in 4, $\frac{1}{2}$ in 8, $\frac{1}{3}$ in 2, $\frac{1}{5}$ in 3, $\frac{1}{10}$ or less in 10 cases; unknown in 2. Of the 12 cases in which either eye was used indifferently V.=1 in 7, $\frac{2}{3}$ in 3, $\frac{1}{2}$ in 1, $\frac{1}{3}$ in 1 case.

An examination of the notes of 200 consecutive cases (400 eyes) of H. and H. As. greater than 1 dioptre abstracted from my private case book, uncomplicated by disease and without squint, in relation to the degree of ametropia and to the vision obtained by full correction (under mydriasis), shows: H. and comp. H. As., between 1 D. and 2 D. in 98, between 2 D. and 3 D. in 40, between 3 D. and 4 D. in 17, between 4 D. and 5 D. in 13, higher than 5 D. in 9 cases. Also 23 cases in which H. of one eye exceeded that of the other by 1 dioptre or over, with a difference of one-third or more in the acuity of vision. V. = 1 in 310, $\frac{2}{3}$ in 24, $\frac{1}{2}$ in 11, $\frac{1}{3}$ in 12, $\frac{1}{5}$ or worse in 43.

My purpose in this brief analysis and comparison is to prove clinically that:

1. H. is found in nearly all cases of internal squint. Ninety-two eyes of the series had hypermetropic refraction.

2. H is not essential to convergent strabismus. Two cases, Nos. 20 and 25, had low myopia.

3 Congenital amblyopia is almost uniformly present in constant internal squint. Amblyopia in this connection means decidedly diminished vision from no known cause without pathological changes and not correctible by glasses. In 38 squinting eyes V. = 1 in 2, $\frac{2}{3}$ in 4, $\frac{1}{2}$ in 8, $\frac{1}{3}$ in 2, $\frac{1}{5}$ or less in 19 cases; unknown in 3. The exceptions—where V. = 1—were Nos. 9 and 33, evidencing no reason why one eye should invariably be used for fixation.

4. Amblyopia is not essential to squint, either constant or alternating. Cases Nos. 9 and 33 are illustrations of constant squint without amblyopia, and Nos. 20, 21, 25, 26, 28, and 49 of alternating squint with full V in each eye.

5. Amblyopia is found in H. without squint. Among the 200 cases of H., V. was equal to one-half or less, without known cause in one eye and normal in the other in 9. Two cases serve to illustrate this statement No. 1. Female, age, 46: R. + 7 ⊂ + .50 c. ax: .45° = $\frac{6}{6}$; L. + 7 ⊂ + .50 c. ax: 135° = $\frac{6}{30}$. No. 2. Female, age, 45. R. + 3 ⊂ + 2 c. ax: 35° = $\frac{6}{6}$; L. + 3 ⊂ + 3 c. ax: 90° = $\frac{6}{30}$. Instances of nearly identical ametropia with amblyopia among the cases of squint Nos. 23

and 32 are forcible arguments in favor of the causative influence of monocular defective vision in the production of squint.

6. Amblyopia is not a condition of alternating squint. Of the 12 cases in which either eye fixed, V. was equal in the two eyes with one exception, No. 44, where the difference can be accounted for by the higher optical defect. Its action, then, must be negative in the causation of alternating squint.

7. Amblyopia precedes the appearance of abnormal convergence and is not the result of nonuse. We have no means of determining with any degree of accuracy the inception of amblyopia, but that it is congenital, and hence antedates the squint, would seem reasonable, because:

(*a*) The duration of time after the squint was noticed until examination of the acuity of vision is, in the great majority of cases, too short to admit of the possibility of the development of the loss of vision from disuse. At no other time of life than in early childhood, and under no other conditions than those of functional internal squint, do we find examples of this kind of amblyopia. The retina may be shut off from participation in vision for many years by an opaque lens and retain acute sensibility. Other illustrations of this fact are not wanting. If squint causes amblyopia, amblyopia must always be associated with squint and should be cured after the axes are made parallel by operation. Neither of these assumptions is true.

(*b*) That binocular fixation secured after tenotomy is retained in a small proportion of cases, and in the great majority the result of operation is cosmetic only.

(*c*) Amblyopia does not follow, at least within several years, paralytic deviation of one eye. The image seen by the deflected eye is after a time consciously suppressed, but visual acuity does not degenerate into amblyopia.

8. The degree of H. does not determine the squinting eye. The table of cases shows the same error of refraction and in constant squint in 14; the higher defect in the fixing eye in 3, and lower H., but higher As., in the squinting eye in 4 cases.

9. The degree of H. does not determine amblyopia. A majority of cases shows practically the same degree in both eyes; a minority anisometropia; but similar differences are found in an equal number of cases which have never squinted and which have no amblyopia.

10. H. may be the determining cause of squint, since (*a*) all the cases with two exceptions were hypermetropic; (*b*) the relation of accommodation to convergence in H. encourages abnormal convergence; (*c*) convergent squint is sometimes cured during paralysis of accommodation and by wearing correcting lenses. There must, however, be other causes than H. in the majority of cases of squint, since—

I. H. is exceedingly common.

II. The proportion of cases of squint to cases of H. without squint does not exceed 1 to 50.

III. While squint is most common in H. of 2 D. to 4 D. (20 per cent), the ratio of cases of H. between 2 D. to 4 D. without squint to H. of other degrees is nearly 25 per cent.

IV. Internal squint is found in myopia.

11. H. As. must be considered equally with H. as a refractive cause of squint, and it may be, in some cases, the more important factor in determining the squinting eye. Astigmatism of 1 dioptre or over was present in the fixing eye in 21, in the deflected eye in 18 cases. The latter number should be modified by 5 cases in which, on account of amblyopia, it was not measured, but was probably present. In the 400 hypermetropic eyes without squint the number of eyes with As. of 1 D. or over was 49=12½ per cent. Hence As. is relatively more common in H. with squint than among those without squint. The axis of the correcting cylinder was vertical or within 10° in the deviating eye in 8, symmetrical in the two eyes or

within 10° in 6, and unsymmetrical in 4 cases. The remainder had As. of less than 1 D. or its degree was unknown. Among the cases of H. without squint 152 had As. in both eyes. Of these, 59 had axes vertical or within 10°, 33 had axes symmetrical or within 10°, and 50 had axes unsymmetrical. From these figures it is difficult to ascribe any importance to the direction of the axis of As. as a factor in the production of squint.

The second part of the proposition was true, in cases No. 7, As. 2 D. higher in the squinting eye; No. 23, 1 D. higher; No. 32, 1 D. higher; No. 41, 1.50 D. higher; No 43, 2.50 D. higher; No. 50, .50 D. higher. In several cases where V. was decidedly bad and glasses made no improvement, it must be remembered that the As. was not recorded. If these eyes had been examined by the ophthalmometer it is probable that they would have been added to the list. On the other hand the fixing eye had the higher As. in Nos. 14, 24, and 47. It was practically the same in both eyes in Nos. 1, 2, 4, 9, 19, 27 (?), 35, 42, and 48. In the cases of alternating squint As. was 1 D. or more higher in only 1, and less than 1 D. in 11 cases (Nos. 17, 18, 20, 21, 25, 26, 28, 30, 39, 44, and 49).

12. A considerable difference in the degree of H. in the two eyes may not cause squint. Among the 200 cases of H. the total defect differed by 1 D. or more in 24, and in some (12) of these cases there was decided inferiority of V. in one eye.

13. Amblyopia determines which eye shall squint, and in its absence either eye fixes indifferently without regard to the degree of H., although it is unlikely that the difference in the ametropia exceeds 1 D.

A consideration of the preceding thirteen propositions leads logically to the conclusion that the generally accepted theory that functional internal squint depends upon hypermetropia must be greatly modified, and hence that our present method of treatment is unscientific and ineffective. We should look rather to the following conditions as likely to cause internal squint: Hyperphoria or hypertropia; congenital amblyopia; hypermetropia, heredity.

I have not discussed the complication which I believe to be most common in unilateral convergence, namely, a want of balance of the vertical muscles, since my data are too insignificant to be of service. My recent experience, however, leads me to believe that constant internal squint is almost uniformly associated with an upward or downward deviation, but whether as a cause or sequence I am not in a position to state. My statistics are incomplete also in that the results of treatment are not tabulated. This is not an accidental omission. Permanent results are difficult to obtain. If the patient is cured by one or more tenotomies he does not return. If he is not cured he consults another surgeon. The few cases of constant squint in which I can state the final result of tenotomies have shown little or no improvements, either in appearance or vision, and I candidly confess I had more failures than successes until I sought and found other causes than hypermetropia.

SOME CONSIDERATIONS RESPECTING EXAMINATIONS AND TREATMENT IN HETEROPHORIA.

By GEORGE T STEVENS, M.D., of New York.

Perhaps I may be pardoned in consideration of the subject assigned for this day's discussion, if I indulge in some satisfaction when I contrast the sentiments prevailing among oculists at the present time regarding that subject with those which prevailed only a few years since. At the meeting of the Ninth International Medical Congress, held in this city in 1887, just six years ago, I read before this section—the same gentleman presiding who now occupies the chair—a paper

with the title, "Some important problems respecting insufficiencies of the ocular muscles." Directly after the publication of this title in the medical journals I was violently criticised in some of the leading medical journals, not for the special views contained in that paper, for it had not yet appeared in print, but for the presumption and folly of suggesting that there were any problems regarding what were then known as insufficiencies of the ocular muscles. The public was emphatically informed that all the problems in this department of science had long ago been solved, and that there was nothing more for me to suggest nor for the profession to consider.

The writers undoubtedly voiced the prevailing sentiment of the profession at the time. Otherwise, had they expressed only their individual views, there would be no occasion for recurring to the incident here. To-day, six years later, this section of this great congress assigns one entire day to the study of the very problems which, six years ago, we were told had already reached a final solution. When, at the request of the president of this section, I consented to participate in this discussion, I was in doubt what I could best offer for your consideration. In reply to my appeals to the president to tell me what part of the subject he wished me to present, he gave me the whole field to discuss, but he did not give me more than one day in which to do it. At the last hour I have determined to speak, not of new things, but to direct your attention to some things of which I have already spoken, but placing them in a light which may possibly encourage some inquirer. If I shall be able to accomplish that, I shall be glad that I have chosen this course.

In the first place, I venture some words in regard to examinations for heterophoria. Perhaps the suggestions that I am to make are needless repetitions; yet I am led to the belief, by examining much of the current literature of the subject, that it may not be out of place to call attention to the fact that views from many points and much careful and logical thinking are essential elements in the making of these investigations. It is not, in the brief time allotted to me, possible to go into any details of examinations, but permit me to suggest an order and some important points which may be brought out by an orderly examination.

The facial expression of our patients will often give us strong hints of what we may expect to find. Indeed these expressions are so well marked in their relations to the condition of the ocular muscles that one who has had considerable observation and who is withal a close observer will rarely fail to make a general diagnosis of his case without the aid of his instruments. Of course, this is not a working diagnosis, but it is a valuable aid to that which is to follow, and often serves to direct the attention to slight inconsistencies in the instrumental examinations which otherwise might escape notice. A glance at the eyes themselves and at their movements prepares us, after we have learned what is necessary of their refractive condition, for the more exact examination.

First in order, after considering well the facial expressions and the movements, the phorometer is brought into use and its results recorded. If other instruments than the phorometer are employed for the purpose of indicating the manifest heterophoric tendencies, either by induced diplopia or by contrasting images, let me repeat what I have already said elsewhere, that no instrument of this class which is held near the eyes, or the correcting prism of which is brought close to the eyes, can be relied upon for such exact examinations as should be obtained if we are to make a critical study of our case. Some of the instruments which are in common use will give us false information to the extent of many degrees. The tendency to overcome a deviation of the images from the vertical or the horizontal lines is similar if not as strong as the instinct to unite images by overcoming prisms. If the phorometer is placed at the distance of from 4 to 6 inches in front of the eyes these adjustments, which are so naturally made, are either

entirely or in large measure neutralized. In whatever way we ascertain the phorometric measurements, we must bear in mind the important fact that we have arrived at only a single stage of the examination, and that other classes of facts must enter into the question of interpretation of the ocular adjustments. We must ascertain the abducting and the circumducting ability, and perhaps, also, the adducting ability. We are to observe the action of each eye when temporarily excluded from fixation and when it returns to fixation. If, assuming the standard abduction to be 8° at 20 feet, a standard adopted by myself many years ago, and which experience has shown to be a correct one, we find that it corresponds to the record of the phorometer, and if the circumduction right and left also corresponds to the indication of the phorometer, we may fairly assume that we have an uncomplicated case in which the reading of the phorometer may be taken as an index of the actual condition, so far as the kind of tendency is concerned. But if, as often happens, the records of the various tests; for example the phorometer, the abducting ability, the deviation in exclusion; are not in harmony, we are to search for the cause of this want of correspondence. For example, if by the phorometer we find esophoria 2° and abduction 6°, or even 5°, with equal circumduction and no hyperphoria, we arrive at the conclusion that we are dealing with a case of simple esophoria, 2° of which is now manifest. On the other hand, should we find esophoria 2° with abduction of 10°, or exophoria of 2° with abduction of 6°, we may at once conclude that we have a complicated case, even although there is no manifest hyperphoria, and one which must demand the most careful attention before any radical measure of treatment is adopted.

There are so many forms of these contradictory indications that I can only allude to them as a class as indications for the most careful study of the cases and as warnings that we must in no case assume that one class of testing tells us the whole truth. We should note the facial expression, test by the phorometer, try the ability to overcome prisms, examine carefully the rotating ability of each muscle and the action of one or other eye when excluded from fixation. These and often many other points are to constitute elements in our examination. And here let me add that if we are at the present stage of knowledge of this subject to publish our case the bare statement that the patient had an abduction of only 5° or that the phorometer showed a certain degree and form of heterophoria will not suffice for critical readers. Such readers must know all about that case. They have seen too many instances in which an abduction of 12° with an actual converging squint to accept such a bare statement as having any scientific value. Moreover, such a statement leaves in the mind of the critical reader the impression that the writer had not himself ascertained the remaining facts necessary to a just conclusion in regard to the nature of his case. A single word more regarding these examinations. Contrary to the general impression and contrary to my own teachings of many years ago, the correction of the refractive anomalies by glasses during an examination of this kind is not only in the vast majority of cases unnecessary, but positively detrimental, as the glasses themselves often lead to error, and their absence does not as a rule influence the muscular conditions.

And now that we have, in the few minutes, gone over the examinations in heterophoria, a subject which for its proper consideration would require the patient study of many months, let us as briefly sketch an outline of some of the methods for the management of the defects which we may have discovered. Let no one suppose that this sketch can be in any degree more than suggestive.

One of the first of the elements in the management of these cases is patience. The oculist who imagines that he can measure and correct his cases of heterophoria in an offhand manner has not reached an understanding of the first principles of the subject. A case which at first appears quite simple and easy to handle

may prove to be one which, for its best correction, may demand the exercise of great skill and of unwearied patience during many months. We can not know when we begin the treatment of a case of heterophoria the full meaning of the indications which we then discover. One who thinks that he has found an instrument which will reveal latent heterophoria is surely laboring under a misapprehension. As we go on in the treatment of these cases new difficulties may arise and new efforts may be demanded. This is no reason for not beginning the work and less for abandoning it before completion. I have sometimes illustrated these progressive difficulties by recalling the experience of one who climbs a mountain. He sees before him a height which appears to him the summit which is to reward him for his effort, but when he reaches it he sees before him another even higher than the one which he has surmounted. He ascends higher, and when at length he attains to the second height, the real summit is still far above him. Is he therefore to say there is no end of this, and one might climb indefinitely without finding the summit? There is a summit, and one may reach it if he has the needful strength and courage. I am sometimes asked by my colleagues if there is no end to the treatment of these cases. Does not the condition which has been apparently removed return? Must the treatment not continue as long as the patient will continue to submit to it? The heterophoric condition which has been in any measure properly corrected does not return, but that part of the original defect which was at one time latent may at a subsequent time become manifest. There is as surely a limit to this work as there is a final summit to the mountain, and when one reaches that limit he has an infinitely greater satisfaction than he who finally gazes upon the grand stretch of hills and plains and lakes from the great elevation which he has earned. Many who do not care to take the trouble to climb decline to accept the reports of those who do; and many an eminent man who has lingered about the foothills of this work is incredulous because he can not obtain the same grand view that has been described by someone who has gone beyond. An essential to success in this work must be a thorough knowledge of the principles governing the tensions of the muscles with which we work. Instruments can not know these principles. They are only to be learned by long and patient research on the part of the oculist. But what immediate steps are we to take for the relief of our patient with heterophoria? We may give him prisms. Will they help? Sometimes, and to a very limited extent. In the large majority of cases they will serve little purpose or perhaps produce decided annoyance. In the cases in which they afford relief that relief is in no sense the effectual degree of comfort and the absence of reflex trouble which may be expected from the more radical relief of abolishing the heterophoric condition. Then we may give to the muscles the gymnastic exercise which may be accomplished by the overcoming of prisms. That good may be accomplished in this way I have long ago demonstrated. The fact remains that the method is but tentative. The anomalous conditions remain, and the unpleasant symptoms will probably return. A vast experience with these two methods enables me, I believe, to speak of them with some degree of authority, and I do not hesitate to say that while they have much value to recommend them, and while no one can afford to overlook them, they fall far short of the more rational measures of actual adjustments by means of equalizing the tensions in such a way as to establish practical orthophoria. We may accomplish this by graduated tenotomies and tendon contractions. Are we then to operate for all cases of heterophoria? By no means. The surroundings of the patient, his methods of work, the importance of the case, and many such considerations must enter into the question of treatment. The best judgment of the experienced surgeon is here in demand. In most cases, however, in which important reflex disturbances are the result of heterophoria we shall find operative measures imperative.

How are we to operate? I must reply first in the negative. How are we not to operate? We are not to operate by the methods described in the text-books which I have seen. Indeed, if I may be permitted to diverge from our strict line of thought in a single sentence, I will add we should never for any condition of heterophoria, strabismus, or paralysis perform any tenotomy after the manner thus described. We should never operate in such a manner as to disable our muscle in its function of rotating the eye. We are told of tenotomies which are so far in excess as, after the relaxation, for example, of a single external rectus, to leave the patient with homonymous diplopia for some months. It is true that single vision may return and that even a condition of exophoria may succeed, but if the ability to rotate that eye well to the temple has been lost at the moment of the operation it will never return without a readjustment of its insertion. Let me impress this important fact upon the mind of everyone who operates for heterophoria, that whatever may happen in regard to phorometric indications, the rotation of an eye after tenotomy does not undergo any very important change and that we can not at the time of the operation disable this function in the expectation that the tendon will readjust itself. We should never attempt a complete and final correction on a single lateral muscle. If we have even a low degree of heterophoria we should proceed on the assumption that when we have finished the work we shall have relaxed the lateral muscle of one eye exactly, or as nearly exactly as we are able to determine, as much as we have that of the other. There is an important consideration too often overlooked in operations for hyperphoria, and especially for hypertropia, that the gaze of the great majority of our patients must be habitually directed downward. Hence a tenotomy of an inferior rectus is, as a rule, to be avoided, unless there are positive indications for selecting that muscle. Before any operation, even in well-defined cases, more than one, and usually many examinations should be made. Prismatic glasses, usually less than a nominal correction of the manifest heterophoria, should be given, and the patient should be charged to use them continuously during waking hours. From time to time, during the use of these glasses, examinations may indicate a greater degree of defects than was at first found and the prisms may be strengthened. The use of temporary prisms which are kept by the oculist, as suggested by me some years ago, has now become somewhat general. After a time, varying from a few days to a few weeks, we have either found such a degree of heterophoria as would be all that we might reasonably expect to relieve by a single operation without risking a restriction of the rotating power of the muscle to be operated upon, or there has been a halt in the further manifestation of heterophoria. We may now proceed with an operation. I have already more than once described this operation, but I will venture to do so again in order to introduce some details concerning which inquiries have often been made.

Let us suppose the operation to be done for esophoria, and that we have determined to do a graduated tenotomy of the right internal rectus. The speculum being in place, the patient directs both eyes well to the right. The surgeon takes with his fine forceps a minute fold of conjunctiva at the center of the insertion of the tendon. Drawing the little fold of conjunctiva slightly away from the eyeball, with the extreme points of his tenotomy scissors he snips the fold transversely so that an opening about one-half of a millimetre in extent is made through the membrane. Now the forceps, the points being closed, is pressed into the little opening and slightly backward, when the points are permitted to spring apart, after which they are again closed, this time holding a small fold of the tendon just behind the insertion. This little fold of tendon being put on the stretch, the fine-pointed scissors, by little snips, dissects the tendon from the eyeball between the layers of the capsule (which should remain intact) toward one border of the insertion. The sense of feeling of the fingers against the rings of the scissors will, in the hands

of one skilled in this operation, inform him of his approach to the border and warn him against its destruction. In extreme cases, like strabismus, the surgeon may determine to continue his section through the border, leaving uninjured as far as possible both the anterior and posterior lamellæ of the capsule as well as the expansion at each border to hold the muscle in its relation to the eye. Turning the scissors then in the direction of the other border, this portion is dissected with equal care. With as little delay as possible the patient is placed in the examination chair and the test by the phorometer and by prisms is made. It is safe in very moderate cases, by the first operation, to carry the correction to 0 and the abduction to 10 or 11°; for at the moment there is likely to be a greater nervous relaxation than will be found an hour or more later, and it may be reasonably expected that within a few days there will still be a manifest esophoria sufficient, especially if the temporary prisms were again brought into use, to permit of a relaxation of the corresponding muscle of the left eye equal to that now being done on the right. Such an extent of relaxation may, however, be counter-indicated should it be found that the rotation, which should always be tested before the patient leaves the operating chair, is in danger of being unduly restricted.

Perhaps we find that esophoria is still manifest. The patient returns to the operating chair, when the surgeon, introducing the slender, blunt hook, feels for the point to which the section has been made either above or below. He soon finds, if he is expert, whether the section has been carried far enough in that particular direction; and, if so, he searches at the other extremity. If he now finds room for carrying the section further, he, using the slender hook as a guide, increases the effect of the tenotomy by carefully executed snips of the scissors, and after an examination this process may be renewed if required. If by chance we find that we have erred in judgment and have gained an exophoria with abduction exceeding 11°, we must at once introduce at the exact center of the free end of the tendon a very delicate suture, carrying it through the cut edge of the conjunctiva at the corneal side. There is an occasional exception to this rule, in which, if we permit the patient to wait for an hour or less, the exophoria and excessive abduction disappear spontaneously. We make this suture to include as little as possible of either tissue, and then draw it with great care until we have overcome the exophoria, as shown by the phorometer, when the knot may be made fast. This process, although sometimes demanded in the practice of the most skillful, is always unfortunate. Those who tell us that we should cut the tendon across and then introduce the suture are laboring under a serious error. Should it be found on the following day that the result is not what could be desired, the suture may be renewed, or by removal an increased effect of the original operation may be obtained.

There are conditions which render it almost imperative in a certain small proportion of cases to make adjustments in lateral tendencies which, although not more than nominally correct at the time of making, are such that the experienced surgeon feels almost sure that when he is better able to adjust for a supposed hyperphoric condition will at length prove overcorrections. Such overcorrections, when they become manifest, must be restored to equilibrium. Now, it should be an axiom, a rule never to be forgotten, that we have no right in any case to weaken a muscle because we or someone else has weakened the opponent of that muscle. For example, if, as the result of a tenotomy of the internus of one eye, we have as a result an exophoria of even as little as a single degree, it is inexcusable to cut the externus in order to relax that muscle equally with the excess of relaxation of the other.

Let me repeat we are not to correct an overcorrection by a new tenotomy. In all such overcorrections we should resort to tendon shortening or tendon advancement of that muscle which has been too freely relaxed. If the original tenotomy

has been done in the manner I have just described there will be little difficulty in performing a correction which shall leave no cicatricial bands to interfere with the freest action of the muscle.

We begin in this operation, as in that for tenotomy, by making a transverse slit of one-half millimetre in extent over the point of insertion of the tendon. Then lifting the border toward the cornea by the fine forceps, a little pocket is made by the points of the scissors, extending under the conjunctiva, more or less toward the cornea in proportion to the greater or less effect which we propose to induce. The pocket having been made, the forceps seize the central portion of the tendon, and it is dissected from the eyeball entirely or partially, as the case may be. If it is entirely dissected, then by means of the scissors points acting as a probe, or by means of the lance probe, the tendon should be absolutely freed from any attachment to the surrounding tissues. The fine tendon crochet now catches it at the center and a little behind the section and draws it forward, or if the hook proves to be ineffectual to hold it during the next stages of the operation the fine fixation forceps with catch may be used. The tendon is drawn forward through the little conjunctival opening, when one of the needles from a thread of silk armed at each end with a needle is passed through the central part from one-half to a full millimetre, or even more, behind the cut extremity. Bringing the needle forward until the two extremities of this thread are about equal in length, an assistant carries the lance probe into the pocket already made, and one of the needles, passing by the side of this probe, which acts as a guide, is made to penetrate the conjunctiva at the extreme end of the pocket and the thread is drawn through. The other needle and its thread are managed in like manner, the second needle penetrating a little to one side of the first in order to allow, between the two threads, a little bridge of tissue. Now, the assistant holding the conjunctiva at the border of the wound by means of fine forceps, the surgeon draws upon the ends of the thread, forcing the cut end of the tendon into the little pocket, and when he has thus advanced it to his satisfaction he fastens the threads by tying them across the little bridge. No cover and no especial care are required beyond that needed for perfect cleanliness, and on the third or fourth day the suture may be removed. The greatest danger in these cases arises from the use by the patient of a soiled handkerchief with which he rubs the eye. Against this danger the strictest injunctions are to be enforced. This operation, with such modifications as may be required, I have performed during the past five or six years in many hundred cases, and it has been witnessed by some scores of my colleagues.

DISCUSSION.

Dr. Burnett, of Washington, D. C., said that in view of what had already been said in this discussion it did not seem necessary to insist upon the importance of muscular errors in the production of symptoms referable to the eyes, head, and even remote localities as due to these defects. Probably no one present ever doubted the existence of grave muscular errors and the necessity for their correction. The problems before us, then, would seem to be the best and readiest methods for their detection; the muscle or muscles involved, their extent of involvement, and the treatment necessary for relief. And the further we go into the study of the question the more complicated it becomes in all these particulars. Formerly the dot and line test of Graefe was considered all that was necessary for determining muscular insufficiencies, but now no one of a half dozen or more methods is deemed infallible; and in some cases all seem to fail, and it is only by the exercise of great patience that the absolute power of the muscles

involved can be determined, if at all. I would dwell more particularly upon the difficulties in determining hyperphoria. As we know from the teachings of our physiologists the interni and externi move the visual axis in what is approximately a horizontal plane. Their simple action gives no vertical or rotary motion to the eyeball. So the problem in exophoria and esophoria, pure and simple, is a comparatively easy one. I would call attention to the remark made by Dr. Stevens that a complete tenotomy of the interni, for example, might, by a faulty union, give rise to a pathological rotation of the eye. This he did not think was liable to happen if the muscle was allowed to go free, as when it was sutured. But if this is to be feared so much as the result of the operation, how much more should we consider its possibility as a primary condition. We must remember that the upward and downward movement of the eyes is an exceedingly complicated one and is not made by one set of muscles. The superior and inferior recti and the obliques which make these movements have also a lateral and rotary movement each, and as the recti and obliques are astigmatic in this portion of their action we should in every case of hyperphoria be able to put our finger on the faulty muscle. If we can not, our therapeutics, whatever it may be, must be, in a measure, blind. So far as I am aware, no effort has yet been made to detect and measure this error of rotation in hyperphoria, and yet it must exist in some degree in every case, and it will be different according as the obliques or recti are involved. There is every reason for supposing that the effort on the part of the eye to overcome this faulty rotation and to bring the inclined line of one eye into the plane of the straight line of the other eye lies at the bottom of the trouble in hyperphoria quite as much as the vertical deviation. And it probably also accounts in no small degree for the unsatisfactoriness of the vertical diplopia which we find mentioned not infrequently. It is fortunate, however, that as far as surgical therapeutics goes, there is this correlation in the action of the recti and obliques, for it will enable us when an error is clearly diagnosticated to correct it by an operation on the associated rectus. My friend, Dr. Savage, is the only one who seems to be working on these lines, and I hope his sanguine expectations may be realized. Two years ago I reported to the Ophthalmological Society my experience in tenotomies, and from the favorable opinions there expressed I have had, from my subsequent experience, no reason to recede.

Dr. Gould, of Philadelphia, said that according to Dr. Burnett, who undoubtedly represented the general consensus of feeling of ophthalmologists, the well-recognized treatment in decided cases of heterophoria was that of tenotomy, either partial or complete, according to the circumstances. This to the speaker seemed to be a true tenotomomania, and one illustration of the general surgical debauch of these days, which has also been so well illustrated in gynecology. It should be remembered that surgery is not medicine, that it is the despair of medicine, and a dernier ressort. The true physician only proceeds to surgery when medicine is no longer able to bring relief. The speaker believed that in a very few years from the present time there will be little or no tetonomy in cases of insufficiency of the extraocular muscles. He protested that the whole muscle question is not a muscle question at all; that the origin of the trouble is not in any peripheral organic defect, but that it is almost entirely of central origin or nature, and that it is functional and not organic. A large number of cases of course are to be set aside as due to general disease and abnormal conditions existing in other parts of the system. If this is the true view, the cure must therefore be a cure, not of the peripheral organs, which are not at fault, but of the nerve centers controlling the extraocular muscles, because in uncomplicated cases the disease is a disease, if it may be so called, of the nerve centers and not of the muscles themselves. The essence of the diagnosis consists in the relation between adduction and abduction. Leaving out cases of heterophoria, if we have an adduction of 25°

or 35° and an abduction of from 4° to 8°, there is certainly no insufficiency and no demand for interference with the muscles of the eye. The secret of the whole matter is to reinstate such a proper relation between adduction and abduction. Every case of heterophoria not traceable to general disease, malnutrition, ametropia, etc., the speaker believed to be curable without any operative interference, by a course of gymnastic exercises with the object of developing the strength of the innervational centers. In all other cases of incoördination of the muscles of the body we do not cut a strong muscle or group of muscles in order to strengthen a weak muscle or group of muscles, but instead of that we endeavor to develop the strength of the weak muscles. And so in heterophoria, the true therapeutic measure is to develop the weak muscles. The speaker had discovered by experiment a method of developing these weak muscles, which he believed might be of service, and which had proved very successful in his hands during the last year. In all cases of insufficiency that had not proceeded so far as strabismus, there is during convergence singleness of the images in vision and an increased ability or strength of the coördinating muscles brought into play. The problem then simply consists in carrying this power, developed at the near point of vision, to the far point; in other words, of so developing the nerve centers that the stimulus of converging power shall be enlarged until the same power exists in the distant vision. To illustrate the method the speaker cited a number of cases, in which there was exophoria at 20 feet of from 5° to 15°, and adducting power of from 10° to 20° only, and an abducting power somewhat in excess of that needed. By placing prisms before the eyes, base out, twice as powerful as the patient could fuse at 20 feet, and beginning with the stimulus of convergence at the near point, the object could be very soon carried beyond the near point without producing diplopia, and in a very brief period of time the internal recti muscles had gained their normal strength, the adducting power had increased to 30° or 35°, and the reflex symptoms had entirely disappeared. A number of cases of this kind were cited, in which the cure had been brought about within a few weeks in young people, and in the more neurasthenic or older patients if the insufficiency had not been made to entirely disappear there was a great improvement in this respect, which was first demonstrated by the disappearance of the reflex symptoms. As the weak muscles regain their power stronger prisms may be used, and there is a perfect coördination and proper relation between adduction and abduction. The speaker especially referred to a case in which there was 18° of esophoria. The patient was operated upon, the tendons of both internal recti being completely severed, producing temporarily slight exophoria. To the astonishment of the surgeon the original condition was reinstated within ten days, and the patient's original 18° of esophoria had completely returned. If such a result as this could arise (and the speaker contended that there was a tremendously large element of doubt as regards the results of operations upon the muscles of the eyes) what, then, could be said as regards the infinitesimal delicacy and minutiæ of operations when surgeons speak of correcting half a degree, or one or two or three degrees of heterophoria of any kind? Such a result also conclusively proved that it was not a case of peripheral lesion, but that the trouble lay in the central nervous system, a theory moreover which was proved by the subsequent history of this patient, who refused to submit to further operation, and upon whom the principle of gymnastic exercises of the weak muscles, according to the plan described, was undertaken. Although the 18° of esophoria had remained permanent for some months after the first operations, within a week or two after these gymnastic exercises had been undertaken the patient's esophoria had been reduced to 12 degrees, with a cessation of many of the reflex symptoms. The case is still under treatment and progressing favorably.

It would seem, therefore, that as conservative and wise physicians we should not longer indulge in this glamor of surgical procedure, but with more conserv-

atism that we should seek to remedy defects by physiological and medical methods rather than by surgical methods. The success that in the speaker's practice had attended this plan during the last eight months had been so remarkable as to convince him that the method of carrying the convergence stimulus into the distant vision and the developing of the weak nerve centers was the true and rational method of procedure in these cases.

Dr. Savage said: I am exceedingly sorry that Dr. Stevens is not here, since it is my purpose to controvert some of the thoughts set forth by him in his discussion this morning. I agree with him in many of the views he holds, but I consider that he is wrong in his teaching as to some very important practical points. I agree with the Doctor that associated with muscle errors and depending on them there are peculiar facial expressions. I wish I was as able to interpret these as he is. But he stated that sometimes the facial expression clearly indicated the existence of a certain muscle error which is not at once shown by the tests at our command. In connection with that statement he did not tell us his method of dealing with these cases. We may reasonably infer from what he said further on in his discussion that the facial expression having indicated a hyperphoria, but not finding it with the phorometer it was found by means of prisms in position of rest for the suspected weak muscles, of action for the supposed strong muscles. Continuing this for a few days the latent error begins to be manifest, and the tests begin to harmonize with the facial expression. I believe the facial expression may sometimes be misleading, and that, as an index to a muscle error, it can be proven false or true by our muscle tests. I believe further that means should never be resorted to, under any circumstances, for making manifest any supposed lateral error. If we have a "hint" that we are about to deal with a left hyperphoria and a right cataphoria, it is clear to my mind that we should direct our efforts toward curing the slight manifest error, rather than add to it by bringing out a latent error. If a prism be placed base down before the left eye and another prism base up before the right eye, in the supposed case, the strong muscles will be made stronger and the weak muscles weaker, in comparison. This work could be carried on, up to a certain point, and thus a greater or less quantity of a supposed latent error may be manifest. How much better it would be to reverse the order and make it possible for the error already manifest to become latent by being cured. Place the prisms in position to strengthen the weak muscles, regulate the exercise as to intensity and time, and they will grow strong. The only object we could have in view in increasing the hyperphoria is that a sufficient quantity may be shown to justify operative interference. This seems to me to be a very roundabout way to effect a muscle balance; and I believe it to be a very incorrect method. If one believes the operations alone can correct muscle errors, then he must of necessity often resort to the work of making manifest much that is latent, so that an operation might be indicated.

I must dissent from another thought which Dr. Stevens emphasized this morning. He plainly stated that he did not believe the accommodation has anything to do in the way of causing or curing any form of muscle error. In this I believe him to be wrong, so far as the latent muscles are concerned. As evidence, I want to introduce one of his own cases. A few years ago in one of his publications he gave the history of a patient who, when a little girl, had an internal squint; later in life there developed a slight deviation outward, but now, on instilling atropine, she suddenly developed her old internal squint. He published a picture of this patient, representing her as a little girl with an internal squint; also a picture representing her as a woman approaching middle life, with eyes comparatively straight; and still another picture, showing the same woman, at the same age, under the influence of atropine, which had excited a high degree of internal strabismus. He states that the squint disappeared when the effect of the

atropine passed away. Having had patients like this one, I am sure I do not err in the statement that she was hypermetropic, though the Doctor's report did not give her refraction. Early in life, where she had full ciliary power, the activity of the centers controlling the ciliary muscles excited a tendency to activity in the centers controlling the converging muscles that would not be restrained by the guiding sensation, and one eye turned in. Later on the ciliary muscles having lost much of their power, the centers controlling these became less active and correspondingly there was less excitation of the converging centers, so that the guiding sensation again assumed control of the internal recti, the squint disappearing simultaneously. Atropine suspended what ciliary power remained and, as a consequence, very imperfect images were formed on the retinæ. The guiding sensation, not being satisfied with these images, called on the accommodative centers for help. In response to the call, these centers generated an impulse and sent it out to the ciliary muscles, but they were not aroused. Another complaint went forth from the guiding sensation, more urgent than before, and by it a greater degree of activity was excited in the accommodative centers; but every impulse, though increased in intensity, found the ciliary muscle unresponsive. In this manner the calls and responses were kept up from hour to hour. This activity of the accommodative centers was attended by a corresponding tendency to activity on the part of the converging centers, which tendency having thrown off the restraining influence of the guiding sensation, became unrestrained action, developing the internal squint. As demands on the accommodative centers ceased, the unusual excitation of the converging centers passed away, and with it the muscles again became obedient to the restraining commands of the guiding sensation, and the squint was no more.

I have had numbers of just such cases, and have often amused myself by satisfying the guiding sensation with sharp images by placing correctly centered lenses before the eyes, when, as if by magic, the squint would disappear, only to appear again the moment the glasses were raised. For this there can be but one explanation; the sharp images (made so by the lenses) satisfied the guiding sensation, which instantly ceased its calls on the centers of accommodation, and as a consequence both the centers of accommodation and convergence became quiet. We need no stronger evidence that the centers of accommodation have the power of changing the "balance" between the external and internal recti-muscles. If this relationship can develop a squint, certainly it can cause an esophoria, which is a "latent" squint. If glasses, properly centered, can cause a squint to vanish, is it incredible that glasses can cure an esophoria which depends for its existence on an uncorrected hypermetropia? In a recent publication I have termed this a pseudo-esophoria and distinguish it from intrinsic esophoria, which can not be cured by convex lenses. The two may be associated in a case of uncorrected hypermetropia, while the intrinsic form can only exist in cases of emmetropia and myopia. In volume 2, No. 11 of the Ophthalmic Record, this whole subject is dealt with at length. While glasses have the power, when properly adjusted and properly centered, to cure some pseudo-muscle errors, they have no power at all over intrinsic heterophoric condition. As pseudo errors may be classed those muscle anomalies dependent on decentration of the muscles, and these can be cured, and ought to be cured, only by prisms in position of rest, or, what is the same thing, by decentered lenses.

Since focal corrections can do nothing for the cure of intrinsic muscle errors, and since prisms in position of rest should never be prescribed for a correction of these errors, the question naturally arises, "What shall we do for their relief?" There are two plans of treatment, each appropriate in its place: Rhythmic exercise for developing the weak muscles; operations, partial tenotomies for weakening the strong muscles, and shortenings for giving greater power to the weak muscles.

The indications for the one or the other are clear to my mind, and my practice is governed by these indications. When there is exophoria of any quantity in the near but none in the far, the case does not admit of operation. The plan of rhythmic exercise which I have introduced will cure the exophoria in the near and allow orthophoria for distance to remain. An operation in such a case would give as much esophoria in the distance as it cures exophoria in the near; therefore it should not be thought of. Again, when there is esophoria for distance and orthophoria in the near, the error for distance can be cured by gymnastic exercise allowing the orthophoria in the near to remain. An operation would give as much exophoria in the near as it cures esophoria in the far; therefore it should not be done. A hyperphoria of less than 1½ degrees should be cured by gymnastic exercise. When there is exophoria both in the far and near, that for distance should be corrected by a partial tenotomy of one or both external recti, and later the exophoria remaining in the near should be cured by developing the internal recti by exercise. When there is esophoria both in the near and the far, that in the near should be relieved by operating on one or both internal recti, and the esophoria remaining in the distance should be cured by developing the external recti by exercise. When there is hyperphoria of more than 1½ degrees an operation on the tendon of the superior rectus should be done to effect a part of its cure. Rather than overcorrect, it is far better to fall short of a full correction, and cure the remaining part by developing the weak muscles by rhythmic exercise. No muscle should be operated on more than once. If an exophoria for distance can not be corrected by a partial division of the tendon of each external rectus, the balance should be accomplished by shortening one or both internal recti. Reversing the order, the same course should be pursued in very high grades of esophoria.

If in a high grade of hyperphoria there should be more than 1½ degrees of the error after a partial tenotomy has been done on the strong superior rectus, a similar operation should be done on the strong inferior rectus of the fellow eye. Shortening or advancing a superior or inferior rectus will not often be necessary; I have never seen a case requiring it.

When I am about to operate I decide beforehand what I want to accomplish, and do what I undertake without resorting to tests during the operation. I always aim in exophoria and esophoria to divide the effect between the corresponding muscles of the two eyes, but as a rule do not operate on the second muscle within four weeks. Not infrequently I find that my first operation has accomplished all I desired. Never has the first, and in only two instances has the second, operation accomplished more than I wanted, and my operations run up into the thousands. Before devising the rhythmic exercise treatment I did desire, not being able to do better, to give by my operation some esophoria for distance in relieving some of the exophoria in the near, and *vice versa*. With Dr. Gould, I agree that unnecessary operations have been done on the ocular muscles, and that bad results have followed, all of which is to be regretted. These errors can be, and should be, avoided. The fact that bad results have been seen should not and, I dare say, will not drive all thinking men from acting on sound prinicples. These operations can not be called surgical debauchery when carefully and skillfully done. There is nothing under the sun more sure than that there are intrinsic errors of the ocular muscles, errors the nature of which may be clearly understood, errors that can not be cured by any and all medical means at our command, or that may be at our command in the future. Even glasses, purely surgical appliances, can not alter the true nature of inherent muscle troubles. Glasses and medicines, I grant, may so act on the nervous system as to make these errors more tolerable, at least for a time. But the errors are there still in spite of all these means. As they can be made more tolerable by improved systemic conditions, they can, on the contrary, be rendered less tolerable by sys-

temic derangements and extraneous causes that disturb mental equilibrium. The fact remains, and will always remain, that intrinsic muscle errors; errors due to hyperdevelopment of the too powerful muscles, or to a more favorable attachment of these muscles to the globe, or to their having inherently and persistently a too abundant nerve supply; can be cured by any one of two means, both surgical in their nature; first, operation on the strong muscles; second, development of the weak muscles by proper gymnastic exercise. The indications for the one or the other of these, or for both combined, are clear in most cases. Surgery is not the despair of medicine, but medicine's hope. As to ocular troubles, medicine does not appeal to surgery in vain. The two forms of ocular surgery applicable to the ocular muscles will go locked hand in hand down the ages, each to do its own proper work and ever ready to call on the other for aid in time of need. No, the days of well-done partial tenotomies are not over, nor will they end with the hundredth generation of oculists to follow us.

Dr. Risley remarked that heterophorias declared themselves in the facial expression of his patients. He was sure that those who devote themselves to the study of this complicated and intricate subject must sooner or later exhibit the results in their anxious and haggard faces. The gentleman who had preceded him had been preserved from the gray hairs, so numerous in the section, by the buoyant faith in his methods. For his part, the gloved hand of conservatism was controlling more and more his management of the errors of muscular balance. While the careful study of the relation between convergence and accommodation was of great importance, no study of these cases was complete which did not take for its starting point the etiology. The proper dynamic relation between the interni and externi was as 3 to 1 determined at 6 m. This was based upon the careful study of a very large group of corrected eyes in which no muscular anomaly existed, and astenopia was absent. When this relation does not obtain errors of muscular balance may be assured. The etiology of such disturbance is important and should control the management of the case. Some cases are unquestionably congenital and possibly due to errors of development; in others, seen in adult life, the esophoria is a residuum of periodical converging.

Strabismus in childhood.—This could in some cases be demonstrated by the study of photographs taken in childhood. Foreign irritations were not infrequently the cause of trouble in ocular muscles. He related the history of a case in which a pessary had removed the heterophoria, which had seemed to require tenotomy. The ocular muscles were subject to disturbance by general diathesis as are the other muscles of the body, rheumatism, gout, etc., and a heterophoria might, therefore, be due to a rheumatism of one of the muscles or the residuum of a palsy. It was probable that a muscle once the subject of a palsy, whether peripheral or central, never entirely recovered its original efficiency.

Disturbance in ocular balance was often the initial symptom in babes, or disuse at the origin of one or more of the nerves supplying the ocular muscles, and error was very liable to creep in at this point. He could not agree with the diction of Dr. Stevens regarding the refractive errors in relation to muscular trouble, since, in his judgment, the two were inseparable in that group of cures of peripheral origin.

Dr. Baker, of Cleveland, said that he thought Dr. Gould would have little occasion to regret his strong condemnation of the promiscuous snipping and cutting of the tendons of the ocular muscles now indulged in by certain ophthalmic surgeons. He said that for many years we have been endeavoring to so perfect our means of correcting errors of refraction as to be able to cure cases of strabismus without resorting to tenotomies, and now that we had about succeeded in curing most of these cases without operative interference in which there is a positive rational indication for operation. These fellows come along and tell us that we must

operate in every case where there is the slightest deviation. He believed division of the tendons in most cases to be unnecessary, and he thought partial tenotomies unscientific and unsuccessful, that a partial tenotomy eventually shortened instead of elongated the tendons, and that when a tenotomy was performed a complete division of the muscle should be made and controlled by a suture, if necessary.

Dr. Woods, of Baltimore, said: The entire discussion seems to point to the fact that the oculist in treating heterophoria must remember that he is a doctor, that he is investigating a condition sometimes troublesome, sometimes not; sometimes intrinsic, sometimes secondary; that the primary cause is sometimes in the eye, sometimes elsewhere. As Dr. Burnett has said, we are to look into the etiology. If we are not capable ourselves of meeting the remote conditions, we should seek help rather than do a doubtful operation. Dr. Risley has, I think, given, as nearly as they can be given just now, the correct principles. I have had a case similar to the one he mentioned; a young woman employed in a store, whose head and eyes pained almost constantly. Correction of myopic astigmatism against the rule failed to relieve her; so did prismatic correction of an exophoria. An operation to remove a uterine defect and some menstrual disturbance cured her, eyes and all. I have a patient, a lady, who does a great deal of eye work, and who for several years has obtained relief from headaches by wearing cylinders; yet she has a hyperphoria of 2½°. Surgical interference in this case would have been bad. In the first, it could not have reached the real cause; in the second, there could be no reason for correcting a "tendency" which was doing no harm. On the other hand, when the heterophoria is intrinsic, and really causing the disturbance, results are brilliant. The gratitude of patients thus relieved, so well presented by Dr. Risley, shows what great good can be done. The question is to determine what cases need operation.

There are a few points in the papers of the morning, and remarks made at this session, about which I should like to say a word. Dr. Stevens's advice for journal writers to give all the details of a case in reporting, and not simply say "such and such an error of so many degrees," should be followed. Such reports of cases, in the present state of heterophoria, are useless. I wish very much Dr. Stevens was here this afternoon to explain why correcting glasses should not be worn during the muscular examination, as he stated this morning. This contradicts all his former teachings, as far as I know, and opposes all the recognized principles of refraction. According to my way of thinking, an examination of the muscles without refraction correction would be valueless. Dr. Savage has said he "would not develop the interni out of a near exophoria," and "would correct the esophoria up to its amount at the near." If the principles I advocated in my paper this morning are correct the former might be a normal condition, and it might indicate either hypersthenic or weak ciliary muscle. The clinical significance of the esophoria at the near would depend entirely on what had been found at 20 feet. If more esophoria, how much more? I do not believe that any valuable information about the intrinsic strength of the recti muscles is to be gotten from the near equilibrium. This is gotten at 20, and the near test is made for an entirely different purpose. It seems to me Dr. Risley has underestimated the normal proposition of adduction to abduction. I am inclined to think that it is more frequently 5 or 6 to 1 than 3 to 1. The cross shown by Dr. Zeigler this morning for the near test seems to me too large to bring out exact accommodation. The smaller the object, the better. Again, it should be mounted on some sort of a rod which would keep it at a fixed and definite distance from the eye.

Dr. Zeigler said: I hereby agree with what Dr. Woods has said in regard to the interrelation of the distance and near test. This is illustrated by an anomalous case I related in which the esophoria for near was 6°, while for far it was only 2°. I was compelled to bring the eye to orthophoria for near, with the accompanying transfer to exophoria of 4° for distance, before I could secure comfort in the near

work. I do not find that the record of muscular power bears any important relation to either operative or prismatic correction of heterophoria, although we should have an accurate knowledge of it for other purposes. Dr. Stevens, I believe, said that he did not believe in the statement that the ciliary muscle may disturb the condition of the extrinsic muscle of the eyeball. I think we have all seen temporary heterophoria from ciliary spasm, and per contra ciliary spasm from functional muscular errors. The relation between accommodation and convergence is certainly an intimate one. Relying on this fact, I always adjust the proper constant correction in my trial frame, and place in front of patients' eyes in both operative and nonoperative cases. In fact, a test with and without the refractive correction will show different results, just as a test under mydriatic is only a matter of interest, and not to be relied on, because the accommodation is suspended. Dr. Stevens referred to a case in which I overcorrected the exophoria 5°. It was a case of esophoria of 20° reduced to orthophoria by the total tenotomy, which had receded to 10° base out. A complete tenotomy was made on the internal rectus of the other eye, overcorrecting 10°, and again it slid back, coming to orthophoria or 1° beyond. I think the history of this and similar cases justified me in doing as I did; and five months of comfort for the patient goes to prove the same. In regard to advancement I prefer the capsular advancement in heterophoria and the muscular advancement in heterotropia or squint. To get the best effect in the latter cases the adhesion should not be loosened but drawn up with the muscle. In regard to covering the eye: I am a firm believer in light dressings. In cataract extraction and other operations requiring corneal incision I use two strips of plaster in the shape of a cross, one from the upper to lower lid. But in these walking cases exposed to the weather and having considerable bloody ooze I prefer a light compress and Lilbright patch for the first day and night. I have seen one case in which an exposed eye was lost from diphtheritic infection, and I have had one case in my own practice where, in facing a cold wind on the second day, the eye became inflamed and presented a most beautiful picture of culture of staphylococcus pyogenes aureus. While no harm came to this patient I still consider it good judgment to adhere to a light dressing in a certain portion of my cases. I never have used them in every case. In regard to failure to correct cases of internal squint I think we frequently overlook the capsular adhesions which, when cut, may allow the eye to turn from 5 to 10 degrees. They particularly amount to a shortening of the muscle. I think we all use muscular gymnastics with great relief in some cases, and none in others. I agree with Dr. Risley in regard to uterine irritations. I remember a very hopeless case of heterophoria in a woman whom I referred to a gynecologist, who was wholly relieved by an ovarian operation. Replying to Dr. Woods, I would say that I have generally used a smaller cross for the near test, but the engraver has made an error in making this larger cross. The card I presented is the first proof. I do not, however, hold the near-test object at a single point, but take the range.

TREATMENT OF OPACITIES OF THE VITREOUS HUMOR WITH PILOCARPINE HYPODERMATICALLY ADMINISTERED

By Dr T. J. TYNER, of Austin, Tex.

I will not take up your time by giving the anatomy and physiology of the "corpus vitreum" further than to say that it is without either blood, nerve, or lymphatic circulation This opinion is I believe, now accepted by most, if not all, recent authorities and my clinical experience is in accord with it. It would be a pleasure to give a satisfactory theory as to how these opacities clear up under the influence of this drug (pilocarpine). That it differs from all other drugs in its physiological action there is no doubt, and that it is a specific in this

disease, or rather condition, I have demonstrated, at least to my own satisfaction. That there is ever a primary inflammation of the vitreous I can not believe. However ingenious some writers have been in the opposite theory, for the most part, in their conclusions, they have been forced to regard these opacities as the result of some previous inflammation in the uvea. It is most generally believed that a cure is impossible, except in recent cases. This is only in part true, and true only for the reason that the previous inflammation in the adjacent tissues, especially the retina, and from which these opacities or exudates enter, has been such as to permanently affect vision. This is clearly proven by the disappearance of the opacities, without corresponding improvement of vision; and when the media become sufficiently clear to see the fundus the ravages of a preceding choroiditis or retinitis is revealed. The iris, especially in old persons, is frequently atheromatous, the pupil responding to atropine only in part. Such cases are rarely met with, except where they are of long standing, and generally in elderly persons. I treated a gentleman 72 years of age whose vision began to fail six years previously; the media became perfectly clear and vision improved very much, as much as was possible, so far as the vitreous was concerned, but with the ophthalmoscope the scars of a preceding inflammation of both the choroid and retina were made manifest. However, such cases do not detract from the efficacy of pilocarpine in rendering the vitreous clear of opacities. As to how it does it, as before stated, we can not say. That it is not by absorption is almost certain, for so far as is known the vitreous is devoid of absorbents. I will, however, venture the hypothesis that through the lymph channels endosmosis is probable, and that the opacities are disrupted and resolution takes place.

I could not do better than refer you to a paper read at this meeting by Dr. J. W. McLaughlin on "The philosophy of drug action." However much we would like to know the process by which a thing is accomplished, yet the practical fact that we know the agency by which it can be done should be sufficiently satisfying, and my clinical experience warrants me in saying that the hypodermic injections of pilocarpine is a specific in opacities of the vitreous humor. In support of this statement, since the beginning of 1887 I have treated about 31 cases in which there was not one that failed either to fully recover or to be greatly improved. Those only improved were the cases already referred to, in which a precedent destructive inflammation in the uvea had existed. It will not be amiss to state here that in one case in which the opacities had appeared only ten or twelve days before, V $\frac{20}{40}$, at the end of the first week of treatment it fell to $\frac{20}{100}$, showing the inflammation in the uvea to be at its height, but thirty days later V $\frac{20}{20}$. The oldest case treated was 91 years of age; the youngest, 18. The age most susceptible is about 50 or say between 45 and 55. The case of longest standing was eight years, the shortest twelve days; but for the most part between one and two years when the patients present themselves for treatment. Sex, 27 males; 4 females. (*Noteworthy.*) Of the 31 cases, 4 were colored, 1 mulatto. In administering the drug, I proceed with extreme caution, beginning with about the one-sixteenth of a grain twice daily, increasing the dose as rapidly as possible until the full physiological effect is reached, then continue. Generally though, after this, only once daily. A larger dose can be given at the patient's home and with much more comfort than at the office. The reason is obvious. As a rule, the greater the effect of the drug the more rapid the improvement.

DISCUSSION.

In discussing Dr. Tyner's paper, Dr. Chisolm said that he had for many years used pilocarpine by hyperdermic injection for the relief of recent cloudings of the vitreous and with excellent results. He usually commences with a really stronger

dose than Dr. Tyner ends with. He injects one-fourth grain and usually obtains free sweating in a few minutes, with salivation and at times emesis. He had seen no bad effects from these doses. The more prompt and excessive the skin action the more prompt the clearing of the clouding.

ORBITAL TUMORS.

By WALTER B. JOHNSON, M. D., of Paterson, N. J.

Exophthalmus, from any cause, is unsightly, and when it is produced by the presence of some variety of orbital tumor is always to be regarded as an extremely grave condition, for the presence of a growth behind or within the eyeball is serious, and may, even if a suitable case for operation, result in loss of the eye if, as in many cases, it does not terminate in the death of the patient. The histories of the cases of the tumors of the orbital cavity here presented, which differed in their composition and had their foci of development in various localities, are reported, without any special effort at classification, for the purpose of placing them on record, and for the consideration of the interesting features always presented in the study of cases of so grave a character.

Protrusion of the eyeball when presented, as a symptom, for examination should be carefully considered from every standpoint, and the diagnosis and treatment of the possible condition only suggested after deliberate inquiry and investigation and a thorough study of the probable prognosis and requisite medicinal or operative treatment. The important factors which present themselves for consideration, are: The presence of an orbital tumor, and the character of the growth whether benign or malignant. The previous and family history of the case is important, special inquiry being made regarding the affection of any family connection by malignant disease. The physical condition of the patient (cachexia) will frequently indicate the probably malignant form of the disease, although many cases of positively malignant growths have occurred without any apparent physical or constitutional infection. The age of the patient may indicate possible malignancy, a high percentage of malignant orbital tumors occurring early in life. The time of onset is important in indicating the character of the disease, a tumor recently appearing, which has attained great size in a comparatively short time, being much more apt to be malignant than one of slower growth, although even a malignant tumor may be of slow growth, while it remains in the posterior portion of the orbit behind the globe and ocular muscles. When the surrounding tissues have been involved in the orbital growth or have become a part of it, the question of its malignancy is almost settled, as a benign tumor rarely, if ever, extends. The presence of pain is more common in malignant disease but may be present in any case providing the growth has attained sufficient size to cause pressure upon the eyeball and stretching of the nerves. The character of the protrusion and its extent is, if a tumor exist, generally more marked in a given direction, and not directly forward and uniform, as is frequently the case in other conditions. The mobility of the eyeball is more extensively impaired in tumor than in other conditions, and in malignant disease is frequently affected very shortly after the onset, even before the proptosis is marked, while in other conditions presenting excessive exophthalmus an almost normal muscular action may be present. The location of a tumor within the eyeball, or attached to it or to the optic nerve, is an indication for immediate operation before the disease spreads to the surrounding tissues or cavities; the attachment to the eyeball or to the optic nerve is indicated by the proportionate ratio of mobility to the protrusion, the mobility in malignant disease being much more impaired than would be indicated by the amount of the prominence of the eyeball. The condition of the eyeball itself, even when not diseased,

may be an indication for immediate interference, as frequently the pressure effect is cause of excessive pains, congestion, edema, inflammation, and strangulation, endangering the integrity of the globe from malnutrition or induced disease.

The effect of the stretching of the optic nerve upon the vision varies with the different cases and conditions; the sight is, however, always more or less blurred, and may be nearly, if not entirely, lost. Although it can not always be determined positively that an orbital tumor exists, and especially what the probable variety of the growth may be, the diagnosis may be made more readily after the exclusion of any possible cause for the condition other than some variety of abnormal growth.

The presence of a tumor of the orbital cavity having been ascertained, the first and most important consideration is, has it a benign or malignant character? While surmise is profitable and a probable diagnosis may be made, certainty can only be acquired by a microscopical examination of some portion of the growth itself. The diagnosis is rendered more difficult in consequence of the location of these tumors, which is frequently, in the early stages at least, so far back in the orbit that thorough digital examination is not possible. The point of origin is most important, not only in indicating the probable character of the tumor, but also in determining the proper course of the operative treatment to be pursued. The rapidity of the onset of the growth is of great importance, especially if it be accompanied by excessive pain, with extensive protrusion of the eyeball and if the mobility of the globe and the vision be decidedly impaired. The invasion of, or the onset in, any of the surrounding cavities is extremely serious, probably indicating the impossiblity of the removal or evisceration of the growth in its entirety. The operation indicated, in nearly all cases of tumor of the orbit, is the removal of the entire growth; if the location of the tumor will permit it the operation may be made from behind the eyeball, leaving the organ in situ after the procedure. If the tumor involve the eyeball itself, or is so extensive that it precludes the possibility of its complete extirpation without the removal of the eyeball, the entire mass must be removed. If any portion of the tumor remain after operation the cavity must be thoroughly cauterized with the galvano-cautery or the application of a strong caustic paste. In advising operation the most important considerations are: If the tumor is benign; is it endangering the integrity and vision of the eye? Will it possibly disappear without operation? May it be a benign tumor which presents the symptoms and character of a malignant growth? If the tumor is decidedly malignant the important question is the probability of its complete removal, for if not likely to succeed in the entire evisceration of an orbital tumor (and some of the malignant tissue may remain within the orbit or surrounding cavities and can not be removed or destroyed), it is almost certain that the growth will recur with marked rapidity and much more extensively than if it never had been operated upon, and that the patient will succumb much sooner than would otherwise have been the case. The tumor, even if malignant, if confined by the presence of the eyeball and the surrounding tissues will be of comparatively slow growth. Even though there is progressive protrusion, loss of motion and sight, irritation, inflammation, edema, strangulation, and perhaps subsequent disintegration, a tumor which can not be entirely removed should not be operated upon unless the unbearable pain, distressing discharge, and bleeding compel it; for the condition is generally much worse very shortly after the operation has been performed, and the death of the patient is hastened without compensating benefits.

SMALL SPHEROIDAL AND OVOIDAL CELLED SARCOMA OF THE ORBIT.

Case No. 1.—B. D., age 6, August 3, 1886. A strong, well-developed boy, giving a previous history of good health, no cachectic appearance, and no history of malignant disease, either in the paternal or maternal ancestors. One year previ-

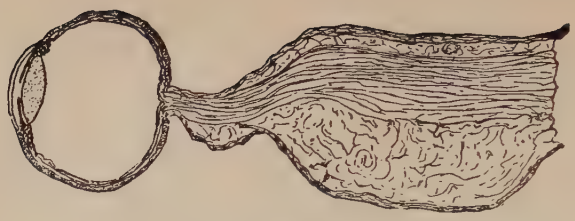

Fig. 1.

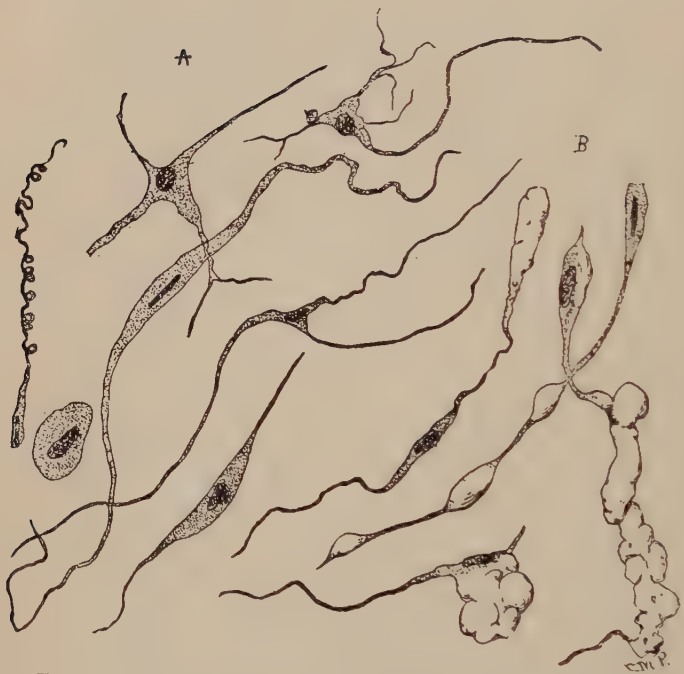

Fig. 2.—A, cells from teased tumor; B, degenerated cells from the same.

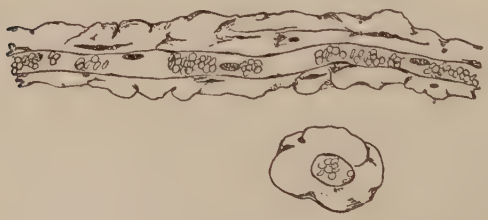

Fig. 3.—Capillary blood vessels with hyalin degeneration of the walls.

Case No. 2.—MYXO SARCOMA OF THE OPTIC NERVE WITH HYALIN DEGENERATION.

ous to the present visit he had an abscess, which broke and discharged at a point 1 inch below the left eye, over the superior maxillary bone. The discharge continued for three days, and was estimated to have been about one-half teacupful in all. The abscess healed kindly, the swelling diminished, but for some time the cicatrix adhered to the bone. At present the skin is movable, and a very small scar marks the point of rupture. Eight months ago the mother first noticed a prominence of the left eyeball, which has gradually increased until the present time; the increase having been much more rapid during the past three months. There is a slight pain occurring once or twice a day; at other times the patient has no discomfort, and does not suffer from headache. The examination discloses the left eyeball displaced forward, downward, and inward, one-half inch anterior to its normal position; the corneal sensibility is not diminished; the pupil is slightly contracted, but responsive to light; the eyeball is reddened; there is considerable lachrymation and some mucous discharge Above the eyeball and to the temporal side, palpation reveals a somewhat movable dense mass, apparently about the size of a Brazil nut; the mobility of the eyeball is only slightly impaired in some directions; the vision equals: R. V. $=\frac{20}{20}$; L. V. $=\frac{20}{30}$ N. I. with glasses. Ophthalmoscopic examination reveals a normal fundus.

August 17: Dr. H. Knapp examined the case in consultation, and advised immediate operation. Since last record the growth has developed rapidly, and during the past five days an increasing haziness of the lower quarter of the cornea has appeared, with a markedly roughened and yellowish area near the limbus and also considerable conjunctival chemosis.

August 23: Operation under ether; a crescentic incision, 1¼ inches long, was made through the upper lid, just below the eyebrow; the dissection was continued with the handle of the scalpel, and the tumor peeled out readily; the bone on the temporal side of the orbit was rough, as though it were denuded of its periosteum. The tumor, a dense inelastic mass, was 1⅝ inches long and three-quarters of an inch in diameter in its widest part; it was somewhat lobulated, having an anterior and a posterior portion and decreased in size as it was more deeply seated in the orbit. The wound was closed, several strands of catgut being placed in the cavity to facilitate the drainage.

August 24: Since the operation constant but slight oozing has continued; the lids are edematous, the conjunctiva less chemotic than before the operation, the cornea is still hazy, but the roughness and yellowish appearance is improving.

August 27: The stitches were removed; the wound had healed except at the most dependent point kept open by the catgut drainage. There had been but little pain following the operation, and the temperature varied from 99° to 103°; the conjunctival chemosis continues to grow less and the appearance of the eye has decidedly improved.

August 28: The discharge from the wound is of dark color, but not at all odorous; the catgut drainage was removed and a small rubber drainage tube inserted in its place; a pressure bandage was then applied for the night, hot-water applications having been used continually previous to this time.

September 8: The patient has improved steadily since last record, the wound having healed kindly from the bottom and entirely closed, the eyeball being normal and in its proper position, and the vision perfect in each eye; the patient was discharged cured.

December 12: Three months after the patient left the hospital apparently cured, he returned with a growth evidently of the same character as the one removed, but much smaller, situated below the eyeball and to the nasal side. An immediate operation was advised. The patient, however, passed from observation and unfortunately no subsequent history of the case could be obtained. Dr. T. Mitchell Prudden, of New York, made a microscopical examination of the growth, and his report is as follows: "The tumor is of an irregular ovoidal shape about 2 inches long and 1 inch in diameter in the thickest part; its texture is firm and dense.

Microscopical examination.—The tumor mass consists for the most part of spheroidal and elongated cells. These cells are in most places closely packed together, but in some parts narrow bands and fascicles of fibrilated basement substance run between and among them. The cells are all small, and the prevailing form is the spheroidal; the tumor is but moderately vascular. The anatomical diagnosis is accordingly: small spheroidal and ovoidal celled sarcoma.

MYXO-SARCOMA OF THE OPTIC NERVE WITH HYALINE DEGENERATION.

Case No. 2.—C. A., aged 22. When 12 years of age she was operated upon for tumor of the optic nerve, which had been first noticed six years before. The case, which was very interesting and unusually rare, was reported in the Archives of

Ophthalmology, Volume XIV, Nos. 2 and 3, 1885, with illustrations and microscopical examination, by Dr. T. Mitchell Prudden, of New York. The child, when first examined in 1883, had an exophthalmus of 13 ", with accompanying inability to close the lids and many disturbing symptoms, which had gradually increased during the past six years, although pain and increasing discomfort had not appeared until the past year. The eye had been sightless for five years and six months; the general health of the patient is and always has been extremely good. The case is again mentioned to record the fact that at this time, ten years after the removal of the growth, there had been no return, even though it had been considered possible that all of the structural material had not been entirely removed at the operation.

RECURRENT CARCINOMA OF THE ORBIT FOLLOWING ENUCLEATION.

Case No. 3.—S. F., 2 years; March, 1892; United States. The child, of Irish and Scotch parents, had enjoyed good health until 1 year of age. There was no history of malignant disease either in the family of the mother or father. One year ago the mother first noticed eye trouble, which she considered an inflammation of the eye, probably caused by cold. When carefully questioned, however, she stated that the eye had not appeared just right from the time the child was 3 months old. She described the pupil as widely dilated, stating that the blue part was absent and that the eye looked peculiar. During the last year the eye has increased in size gradually, until about four months ago, when it commenced to enlarge more rapidly, and the child began to complain of pain. Enucleation was advised by an eminent oculist of an adjoining city, but was not permitted until January 5, 1893, when the eyeball had protruded excessively. Bleeding had occurred, and there was a constant discharge of ichorous pus. The enucleation was delayed so long, in consequence of the objections of the parents, that a successful operation was doubtful. It was, however, performed by the physician above alluded to. For three weeks the orbital cavity seemed to be in a perfectly healthy condition, and the parts appeared to have healed kindly; after this time the orbit began to fill up again, and from that time, about February 1, until March 9, when first seen, it increased very rapidly until it finally emerged from between the lids. The tumor bled frequently and constantly discharged a bad-smelling, ichorous pus. The child was in an extremely restless and enfeebled condition and it died of hæmorrhage and exhaustion three days after.

ORBITAL SARCOMA ORIGINATING IN THE NASAL CAVITY.

Case No. 4.—Miss V. R.; aged, 22; November 15, 1890. First saw patient on above date; at that time she had slight ptosis and a very little paralysis of the left side of the face. She had constant lachrymation from the left eye; was rather delicate; although not frequently ill, was thin and somewhat anæmic. Bowman's operation for opening the lachrymal sac and subsequent probing was advised. The operation was performed in the usual manner and a No. 8 Bowman's probe introduced. For the first four weeks after the operation the patient was seen and the probe passed twice each week; from that time until the 5th of September, nearly one year, she was seen every week or two and the probe passed, with temporary relief, but the lachrymation always persisted to some extent. There was never any unusual bleeding from the nose after probing. The probes were increased in size gradually to No. 13 Bowman's.

On September 5, 1892, she first complained of difficulty in breathing through her nostrils. Examination disclosed a complete occlusion of the left nasal passage; the inferior turbinated bone was covered with hypertrophied mucous membrane and the post pharynx on the left side was apparently filled and closed, so that she could not inspire or expire with the right nostril closed. The removal of some of this hypertrophied tissue was advised, and the operation performed without having inflicted unbearable pain; it was followed by excessive hæmorrhage; the amount of tissue removed was not great; the canulated knife of Dr. Smith was used in operating. There was constant oozing from the nose, and on the second day after the operation severe inflammation accompanied by excessive swelling and violent pain supervened; the inflammation extended to the antrum, the frontal sinuses, and also through the Eustachian canal to the ear. This inflammation subsided very slowly and was attended by severe pain. The patient was treated by local applications and warm douching. In about two weeks the trouble had practically subsided, there was but slight improvement in the nose, although a partial inspiratory effort could be made, but expiration was completely suspended. The peculiar friable feel of the membrane of the nose suggested the pos-

Case No. 3.—RECURRENT CARCINOMA OF THE ORBIT FOLLOWING ENUCLEATION.

Case No. 4.—ORBITAL SARCOMA ORIGINATING IN THE NASAL CAVITY.

sible malignancy of the growth and the patient was referred, with a history of her case, to Dr. F. H. Bosworth, of New York, who made further operations upon the nose which on each occasion was followed by extremely excessive hemorrhages, although his opinion was at that time that the tumor was of a non-malignant type. One month later, in a letter written to Dr. S. F. Wiley, who originally had charge of the case, Dr. Bosworth stated that he then considered the growth to be possibly a myxo-sarcoma and thought it probable that the tumor might have been induced by the probing of the lachrymal duct, although he was not able to locate the point of origin at a point near its opening. The Doctor also suggested the possibility of the excessive pain in the ear being due to pressure on the spheno-palatine nerve, although the inflammation of the middle ear by extension had been considered sufficient to produce the pain. The patient passed from observation from October, 1891, until June, 1893, about eighteen months, when she again presented herself for treatment, enucleation of the left eye having been advised in consequence of an exophthalmus which had gradually increased during the past year and had developed to such an extent that the proptosis of the left eyeball was equal to about 1 inch. The eye was entirely sightless; the cornea in a semi-sloughing condition; there was constant lachrymation and purulent discharge and at intervals distressing pain in and about the eye. The right eyeball had also recently increased in prominence and its vision decidedly diminished, the nose was completely occluded, no inspiratory or expiratory effort being possible through either nostril. The patient seems also to have lost somewhat in mental power and at times is considered by her family to act in a very peculiar manner. In consequence of the extent of the disease being so great and the possibility of a radical operation so slight, any operation was not considered advisable and the patient returned home.

TRAUMATIC EXOSTOSIS OF THE ORBIT.

Case No. 5.—M. E. M., colored, aged 25, married. A strong, healthy woman, with a good family history, and her husband well and free from specific taint. She has had two children, one of which was stillborn and the other died in ten or fifteen minutes. There is no indication of, and she denies, specific disease. Three years and six months ago she was kicked on the left side of her face, causing a contused wound of the left upper eyelid and a general swelling and ecchymosis about the left eye; the wound healed and the swelling entirely disappeared in about a month Six months after this time her attention was called to a "swelling" on the left side of her face, at the edge of the orbit near her nose, which she had failed to notice. This tumor has slowly increased in size, absorbent and alterative medication apparently having no beneficial effect. Two months ago she first noticed pain in the growth, which has at intervals been so severe as to prevent sleep. She also suffers from occasional frontal headaches. The patient has no tenderness in the region about the growth, but immediately over it pressure produces some pain; she has an epiphora, but no inflammatory disease of the eye; the nasal passages are free and clear. The tumor, which is hard and immovable, is situated over the edge of the orbit and extends from the nasal bone, covering part of the anterior surface of the superior maxillary. The tumor was about 1¼ inches in length, and in size and shape very much like a Brazil nut; a linear depression could be felt between it and the nasal bone, the surface was slightly nodular, the skin was not adherent to it, there was some swelling of the adjacent soft parts. Operation was advised and performed. A T-shaped incision was made just below the lower eyelid, over the tumor, 1½ inches in length, and at right angles to this an incision three-quarters of an inch in length just over the linear depression between the tumor and the nasal bone; the periosteum was stripped off and disclosed the growth, which was somewhat cancellous in some parts, while in others it was compact and dense. The growth could not be separated en masse, and in chiseling was broken off in many pieces, as shown in the specimen herewith presented. The edge of the orbit and anterior surface of the superior maxillary bone were thoroughly cleared down to the healthy bone with a pair of sharp-cutting gouge forceps. The wound, which was antiseptically dressed, healed kindly, a slight purulent discharge occurring on the fifth, sixth, and seventh days from the most dependent portion of the wound, its edges having been separated for the purpose. The deformity was removed, a slight scar only being left, which after cicatrization adhered somewhat to bone; there has been no pain and no subsequent increase of bone tissue to present time, six months after the operation.

SPONTANEOUS HÆMATOMA OF THE ORBIT.

Case No. 6.—Miss Z., aged 14, November, 1892. Was first seen November 12, 1892, having been referred by Dr. George T. Welch, of Passaic. The right eye was

excessively protruded, the exophthalmus being so great that there was severe pain. The eyeball was displaced downward, forward, and outward, fully three-quarters of an inch in front of its normal plane, a tense swelling resembling a malignant tumor of the orbit was situated above and to the nasal side of the eyeball. Three days before her first visit she suddenly felt a severe pain in the right eye, which was immediately followed by the tumefaction. There was no ecchymosis present; the mobility of the eyeball was greatly impaired. An exploratory puncture was advised and performed with a hypodermic needle, which was thrust into the tumor; a syringeful of dark-colored, liquid blood was withdrawn. The pain was relieved at once and the subsequent absorption was very rapid, the exophthalmus having entirely disappeared in about two weeks. There was no subsequent ecchymosis or pain. The removal of a portion of the extravasated blood by an hypodermic needle in such cases would seem to be very desirable, as the process of absorption is retarded and can not be satisfactorily established until the excessive pressure is relieved.

CARCINOMA OF THE NASAL FOSSA EXTENDING TO THE ORBIT AND SURROUNDING CAVITIES.

Case No. 7.—Mrs. M., aged 63, a strong, healthy woman, presented herself at the Paterson Eye and Ear Infirmary for treatment. For the past two months she has suffered from inability to breathe through her nose, and for the past ten days she has had violent pains over the frontal sinuses which were very sensitive to the touch. She has no knowledge of any malignant disease in any member of her family or relations. On examination both the right and left nasal passages were found to be filled with masses of a new material which was friable, nodular, and bled profusely when touched. The point of origin seemed to be from the vicinity of the turbinated bones and vault of the nasal passages. The growth was considered malignant. The pain had, during the next two weeks, increased to such an extent that an operation was performed for its relief. The operation consisted in the cleaning out of all the tissue possible from each side of the nose with a snare and the forceps. A large quantity of tissue was removed, including the turbinated bones which were within the tumor mass. The bones were very brittle and the growth came away readily, one large mass from each nostril, and many small pieces. There was considerable hæmorrhage, and oözing continued for three days, after which time the irritation of the operation gradually subsided, the swelling and pain over the frontal sinuses was relieved, and the patient remained very comfortable for five weeks, during which time the growth had gradually increased until finally it became more painful than ever before, and a marked prominence of the right eye began to develop. The growth was examined microscopically by Dr. J. W. Williams, who submitted the following report: "I have made and examined sections of the growth which you sent me, removed from the nasal fossa of Mrs. M., and found it to be carcinoma, the cells being for the most part of the squamous type." The patient desiring further operation in consequence of the unbearable pain was referred to the New York Cancer Hospital, where her right eye and part of the bones of her face were removed, but the growth returned. She was operated upon three times in all, and she finally died, six months after her first visit, from a recurrence of the disease and exhaustion.

A CASE OF ENOPHTHALMUS TRAUMATICUS.

By LOUIS F. LOVE, M. D., of Philadelphia, Pa.

Ophthalmic Surgeon to St. Mary's Hospital, etc.

I wish to present to the attention of the Congress the description of a case of enophthalmus traumaticus. The right eye presents the appearance of being sunken in the orbit. The under lid, with its loose and baggy folds, shows an almost complete absorption of the underlying fat; and that this condition of absorption extends to the whole cushion of fat in the orbit is evident from the fact that the ball is retracted from 6 to 7 millimetres. The retraction gives the eye the appearance of an artificial eye, an appearance which is enhanced by the apparent smallness of the globe. The globe is in reality, however, the same size as its fellow. Microphthalmus was absolutely excluded. The old scar, which is visible on

TRAUMATIC ENOPHTHALMIA.

TRAUMATIC ENOPHTHALMIA.

the nose, has nothing to do with the present disease. The history of the case is as follows:

P. McC., age, 35, was struck with the fist in the right orbital region in March, 1893, the blow being quite a severe one and causing a large swelling of both lids. There was no external wound. The swelling remained for about two weeks and was not treated except by domestic remedies. After the subsidence of the swelling he noticed that the eye appeared smaller than its fellow, and this condition had continued up to the time he presented himself for treatment, three months after the date of the injury. At no time had he suffered pain in the eye itself, and vision was excellent. O. D. V. $= \frac{6}{6}$?? D. = 0.50 18c. 46c. O. D. V. $= \frac{6}{6}$? D. = 0.50 20c. 48c. On examination the globe is found to be retracted 6 or 7 millimetres, but is normal in size; there is no apparent paralysis of any of the ocular muscles, but the movement of the globe was markedly limited in all directions. The lower lid is thrown into folds and presents a flabby appearance. There is no ptosis, and the patient states that at no time was double vision present. The right pupil is about 2 millimetres in size, the left about $2\frac{1}{2}$, both actively responsive to light. Ophthalmoscopic examination showed media clear, disk oval, axis 90°, good tint, vessels normal in size and carrying good blood. In a word, there was apparently no gross pathological changes.

The case which I have thus briefly presented appears to be almost unique. The cases heretofore reported have almost invariably been connected with fracture of some of the bones of the orbit, or were the result of age or disease. In this case there was no evidence whatever of fracture, and all the circumstances pointed to its having resulted from direct violence in a young and healthy man. The literature upon the subject is exceedingly meagre. Dr. Hansell, in reporting a case to the Philadelphia County Medical Society* in which a fracture of the orbital plate of the ethmoid bone existed, has collected what little there is. The older authors are silent on the subject of traumatic enophthalmus, with a few exceptions, and only refer to enophthalmus produced by disease in an incidental manner. Two cases reported by Gessner (Archiv für Augenheilkunde, Bd. XVIII, Hft. iii), and quoted by Dr. Hansell, are similar to mine. In both of these cases the orbital region was lacerated by injury, and a few weeks later enophthalmus of the ball was noted. In both cases the condition remained permanent. A plausible explanation of the condition is that a cicatricial contraction of the retrobulbar fat and cellular tissue occurs as the result of inflammatory reaction, following a wound in this neighborhood. In the case I have the honor to report there was no evidence of wound or deep-seated lesion, though whether the inflammation of the cellular tissue about the eye could have extended to retrobulbar tissue and could have been followed by cicatricial contraction, or more probably by absorption, can not certainly be stated. It is possible that the injury caused a general infiltration of inflammatory products throughout the orbital tissue, and that when these products were removed by absorption, that much of the normal tissue was absorbed with them. But what should cause such an abnormal absorption, and, if such should be the cause, why do we not see more of such results following a blow in this region? We know very little of the trophic nerve system, or even of the normal method of absorption in the orbital region, yet physiological investigation has furnished some facts which may bear upon this case. I am indebted to Dr. Charles K. Mills for literature which he has placed at my disposal. Claude Bernard called attention to the fact that the contraction of the pupil after division of the sympathetic is constantly accompanied by retraction of the globe of the eye, flattening of the cornea, and decrease in the size of the palpebral fissure. The same phenomena he saw also after division of the anterior roots of the two first dorsal nerves and after section of the spinal marrow at the level of the first and second dorsal vertebræ. Irritation of the divided sympathetic or of the peripheral ends of the several anterior roots gave opposite results, prominence of the globe, bulging of the cornea, and enlargement of the palpebral fissure. H. Muller (musculus orbitalis—smooth muscular fibres found in the

* Proceedings of the Philadelphia County Medical Society, Vol. XI, 1890.

membrana orbitalis)* discovered in the anterior orbital fissure a reddish gray mass consisting of bundles of unstriped muscular fibre with elastic tendons analogous to the orbital membrane of the mammalia. He supposed that its action is to protrude the eyeball. It is supplied by fibers from the sympathetic, and irritation of the latter in the neck has been found to cause protrusion of the eye, perhaps through the action of this muscle.† Sappey has described similar muscles in the orbital aponeuroses.‡ The well-known experiments of Euhlenberg and Guttmann on the cervical sympathetic may also be referred to.§ In conclusion, I will state that the case has been kept under observation and any further changes will be noted carefully. The condition is, of course, irremediable by surgical or other means.

FURTHER OBSERVATIONS ON THE EYE OF THE NEGRO.

By CHARLES W. KOLLOCK, M. D., of Charleston, S. C.

In a former paper on this subject it was concluded that the eye of the negro had deteriorated since he became free, and that this was due to the following causes: (1) Syphilitic infection; (2) lack of good and sufficient food and clothing; (3) total disregard of sanitary and hygienic surroundings; (4) frequent sexual intercourse with whites of low condition which has produced the mulatto, who inherits the weaknesses of both races, and therefore is rarely healthy, but generally syphilitic, scrofulous, and tuberculous; (5) education implanted upon such a rotten foundation has produced its ill effects, such as myopia and attendant evils. Syphilis has caused widespread destruction among them, and it is not an exaggeration to repeat that but few remain who do not show symptoms of infection. The eyes, especially, have suffered from this disease, and blindness is increasing rapidly. Ignorant and careless of consequences, they rarely consult a physician when the disease is in its incipiency, so that when seen iritis is usually well advanced, synechiæ firm, pupils occluded, and general inflammation of the uveal tract and choroid is not unusual. When there is keratitis, and this occurs in 37 per cent of all their diseases of the eye, ulcers have extended over the cornea and eaten into the layers proper, and perforation is the rule. When it is realized that so large a percentage have keratitis in some form, and that they rarely seek advice until serious injury has been done, it is not difficult to understand how fast impaired vision and blindness are increasing. Kerato-malacia associated with xerosis of the conjunctiva is a frequent and interesting condition seen in negro children, and more commonly among the blacks than mulattoes. It is not often found in adults, and in Charleston has never been seen among the whites, though there are many who live in similar conditions and who have like surroundings. There can be no doubt but that the disease is due to a lowered vital condition, and it usually occurs in weakly children from one to eight years of age. Some show undoubted signs of inherited syphilis, others are scrofulous, and some tuberculous, with cavities in their lungs and deposits in the mesentery, while others do not appear to have any bodily affliction; but all are night-blind, and this more than any other symptom induces the parents to bring them for treatment. It has been thought that perhaps malaria was a factor in its causation, but examination of the blood so far has not proved anything worthy of note. The existence of a bacillus‖ has been suspected. The negro lives commonly on hominy (grits), rice, fish, and

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* Billings's National Medical Dictionary, Vol. II.

† Soelberg Wells by Bull, A Treatise on Diseases of the Eye.

‡ Sappey's Anatomy, 1876-1879.

§ Journal of Mental Science, Vol. XXXIII, 1883.

‖ It is stated that the bacillus has been found by Dr. Weeks, of New York.

had hog meat, and it is possible that the kind of food may have something to do with the condition.

The whites do not eat as much fat, and the quality of hog meat is better than that used by the negro, who will frequently buy strong-smelling meat in preference to that which has no odor. Treatment does much for those in whom the cornea is slightly affected, but it has been the experience of the writer that when the entire cornea breaks down and suppurates it avails nothing and the patient soon dies. Malaria is undoubtedly a cause of keratitis among them, and when such is the case there will be periodic exacerbations. These cases are rapidly improved by large doses (gr. xx) of quinine given at short intervals for several days in succession. But in all these cases of corneal trouble specific treatment will be of great value. The negro is a curious being: he will sit, ax in hand, on a pile of wood and freeze to death, and he will hold a prescription which can be procured free of charge, and yet not have it filled, so that treatment is not always satisfactory, nor can one depend upon him to carry it out. But for certain things he has a predilection, and one of these is for "salves." Any greasy dirt that he can put in will afford him pleasure. Therefore, taking advantage of this weakness, it is best to begin treatment with mercurial inunction; than which there is no better. He will faithfully rub a drachm of this into his skin twice a day, and the results are magnificent. It is food and medicine; he responds beautifully, and the efficacy of drugs seems assured.

They seem to bear mercury better than the whites, and inunction may at times be continued for two weeks or longer. Conjunctival inflammation of a mild character is more frequently seen among the mulattoes, but this may be due to the fact that refractive errors are more common with the latter, and also that they use their eyes more for trying work than the blacks do. Trachoma is equally rare among both blacks and mulattoes, but undoubtedly occurs. Strange to say, ophthalmia neonatorum is not very common among them. The gentlemen who have done the practice for the poor in Charleston say that it occurs in the blacks less frequently than among the whites. Certainly gonorrhœa does not seem a very prevalent disease with them. Recently two cases of leprosy have been seen in mulatto men by the writer. One man was about 60 years old and the other 35. No other members of their families were affected, nor were they related. Both had the nodular infiltration along the eyelids and the cilia had dropped out. In the older man the diffused progressive opacification described by Hulanicki was shown. It extended upon both corneæ from the upper margins to about the centers. The surfaces were smooth, there was no inflammation or photophobia, and the haziness was either between the conjunctival layer and Bowman's membrane, or involved the latter. In the younger man was seen the other mode by which the disease affects the eye—the nodular infiltration of the cornea. This, Hulanicki says, is seldom a primary affection of the cornea, but usually extends from the sclera. This patient had also some signs of syphilitic affection, as the bones of the nose had been destroyed by ulceration, but leprosy and syphilis seldom coexist in the same person. Refractive errors are not as commonly among the mulattoes as the whites, but as yet myopia is not quite as frequent in occurrence, though it is undoubtedly increasing. In the pure black, refractive errors are the exception; myopia has never been seen by the writer, but as their education advances they will at no distant date have the civilized eye.

DISCUSSION.

Dr. Burnett, of Washington, said he had been interested in the eye of the negro for many years; had published at various times papers on the subject since 1876, and he was glad to find that the experience of Dr. Kollock agreed in all essential

particulars with his own. His experience in Washington, however, has not shown that syphilis is yet so destructive as it appeared to be in Charleston.

Dr. Belt, of Washington, D. C., said that he had seen many cases of ophthalmia neonatorum among the negroes, and that it was not uncommon. He thought it more severe among the whites and mulattoes than among the pure-blooded negroes. He had found iritis very common and nearly always from syphilis, but it usually responded well to treatment.

Dr. Chisolm said that Baltimore, the city in which he lived, had a colored population of 45,000, and that in the books of the Presbyterian Eye and Ear Charity Hospital he has recorded upward of 8,000 cases of disease. These he had not yet collated, but would do so at some early day. Syphilitic troubles were commonly met, especially as iritis, and often with gummata. He thinks glaucoma more common among them than in the whites. Purulent ophthalmia of the newly born he does not often see among the blacks, notwithstanding their general disregard of cleanliness. As to the two cases of leprosy which Dr. Kollock had met with, he would state that in his earlier medical career when he practiced medicine in Charleston for fifteen years he knew of five cases of leprosy, some of whom had been his patients. They were all whites, all relatives, all sporadic cases in large families; most of them among the best people and occurring in early adult life. These cases ran through all the peculiar phases of the disease, with eye, throat, and bone complications, terminating fatally. They were usually members of large families, from healthy parents, with no history of leprosy in the family. During the years that the disease was running its course these persons were in no way isolated, but lived on the most intimate relation with the other members. Some were old enough to be married before the leprosy was developed. Contagion was never considered in the house nor has any case ever shown itself from these constant and close intimacies. The leprosy in these families began and ended with the isolated case, and hence established in my mind the belief that the disease was not contagious.

In closing the discussion Dr. Kollock said that undoubtedly the large percentage of corneal cases seen in Charleston was due to the carelessness upon the part of the negroes in not seeking medical advice earlier. That he found the negro responded well to treatment, but it was difficult to make him carry it out thoroughly.

THE TREATMENT OF TRIQUIASIS AND DISTRIQUIASIS BY LIFTING THE EYELID.

By JUAN SANTOS FERNANDEZ, M. D., of Havana, Cuba.

Triquiasis and distriquiasis are generally the results of prolonged irritation of the free borders of the eyelids; they are consequently most commonly observed in ill-accommodated persons who are more or less exposed to granulations and other inflammatory diseases of the eye that are due to lack of hygiene. This disease has been studied since long ago and many methods of treatment have been proposed against it; epilation and application of calcium sulphite have been employed together with the ablation of the free border. These procedures are, however, of little value, the first being too long and the second non-physiological. A change of direction in the eyelashes is to be preferred. This method, advised by Celsius, which has been since modified by Sorelle, Knapp, and others, is not acceptable on account of the great number of eyelashes which may necessitate the procedure. Moreover, the results only last three months, when it is necessary to perform a new operation. It has been considered better to change the direction of the implantation area of the eyelashes. The methods of Arlt and others have been devised with the view of real-

izing this suggestion. The methods that I propose do not interfere either with the eyelashes or with their implantation area. I only endeavor to change the position of the border of the eyelid by placing a wedge of tissue under the external corner of the eye and maintaining it in position by means of a suture. I desire to expose briefly the facts that induced me to devise this procedure.

The 2d of July, 1891, I was visiting the ophthalmic clinic of the faculty of Lyons under the direction of Prof. Gayet. He stopped before one of the beds and said: "This is a countrywoman of yours on whom I have performed tarsoplasty as a remedy against entropion." It was a girl of Cartagena, who had contracted granulations and entropion in Algeria. I became greatly interested with the new operation, which attempted to resolve the treatment of a disease which I had been sometimes unable to master · and at other times, after having succeeded in removing the symptoms, I had seen them reappear after a year or two. I begged Prof. Gayet for a demonstration, which was accorded, and he recommended to me his work on the matter.* Gayet supposed that the diseased tissue being a scar, the transplantation of a flap of skin would remove all trouble. He desired to cover with skin the internal or posterior surface of the superior eyelid, and he expected that the eye would perfectly tolerate the contact of the new epithelium. His object was, therefore, to lift the border of the eyelid in a way to prevent the eyelashes coming in contact with the cornea. I endeavored to perform Gayet's method, but I met too many difficulties in keeping the sutured flaps in place and I devised the new method.

The observations that I have made prove that in many cases the flap failed to heal and occasionally was destroyed by gangrene. The troubles disappearing even under these conditions, I consequently came to the conclusion that success might be obtained even without complete healing of the sutured flap. I thought it would suffice to slit the external canthus of the eye, dissect the superior border 1 centimetre high, and place underneath a small flap of skin dissected from the temple, and then restore the canthus with a suture. The superior eyelid would thus be increased in thickness and its free border would be situated at more distance from the cornea. The method is based on the anatomy of the obturator muscle of the eyelids. This muscle is provided with fixed and movable insertions. The first are attached to the base of the orbit by means of four portions which embrace the lachrymal bag. The second (movable) are fixed in the deep surface of the skin which is situated in the external portion of the orbital region precisely at the external angle of the eye. These fibers are curved and their concavity is directed toward the palpebral opening. But few fibers of the superior eyelid continue to the inferior one without becoming adhered to the external portion of the region. This condition renders possible the section of the angle without interfering with the functions of the sphincter. This change in the position of the border of the eyelid is the basis of the method performed in the cases that I am going to relate.

Mrs. M. P. G. was seen on August 26, 1880, suffering from granulations and triquiasis. Epilation was tried without success. She was operated on May 22, 1892; a frontal lambeau 4 cm. long was placed under the eyelid after section of the external canthus having revived the mucous surface. To-day she is completely relieved, and no difference is to be detected between this eye and the healthy one.

Mrs. S. B. P., æt. 61, applied on September 8, 1892. She has suffered for thirty-one years. The corneæ were opaque on account of pannus, which had resulted from the contact of the superior eyelids. Tarsoplasty was performed on October 11, 1892, according to Gayet's method. A flap of skin was dissected from the temple and sutured to the posterior aspect of the eyelid. Five days after the stitch at the end gave way, the flap becoming free. Two days after some more of the suture gave way, and the flap being imperfectly attached it was decided to excise it. This was done, and only 2 cm. were left. Twenty days after the patient was greatly relieved.

* Annales d'Oculistique.

S. H., æt. 30, had from childhood a deviation of the eyelashes, which was the result of traumatism. He had submitted to several operations without success. Ectropion of the lower eyelid was resorted to; tarsoplasty being afterwards performed with the view of preventing lagophthalmus. Operation was performed as usual, the suture being partially made with metallic thread. Æsthetically considered, the result was not a very good one, but the troubles were removed enough to allow of rude work.

E. J. A., Chinese (No. 25708), had granulations and distriquiasis, with pupillary atresia. Tarsoplasty was performed by Gayet's method and antiseptic bandage was placed and the flap healed in position, but a little too high. The border of the eyelid was not, therefore, sufficiently raised, and the eyelashes continued to disturb the cornea. A new operation was proposed and was not accepted by the patient.

A. C., Chinese, September 16, 1891; total leucoma, atrophy, chronic conjunctivitis, caused by distriquiasis. Tarsoplasty was performed. A flap was dissected from the temple, the external comisure incised, and suture applied. Three days after the flap was still adherent, but in March the patient was newly examined and but traces of the flap were found. The troubles were, nevertheless, relieved.

C. G. P., of Canarias, æt. 22, May 14, 1888—granular conjunctivitis, triquiasis, and distriquiasis of both eyes. She has applied daily for five years. Epilation and other treatments proved unsuccessful. February 9, 1892, I resolved to perform the operation which I had devised instead of that of Gayet. I accordingly dissected a small flap from the temple, which I placed under external angle; several points of suture finished the operation. Immediately after operation the free border of the upper eyelid was seen to be a little before the lower one. Later, however, this condition became less marked, sufficient difference remaining how-how—just enough to prevent any trouble arising from the contact of the eyelashes.

C. G. P. is the same person, the operation involving the left eye. The operation was the same, though greatly simplified. The flap was 3 cm. long and was sutured to the eyelid after incision of the angle. The success was as complete as in the other eye.

From the perusal of the foregoing chapter it will be seen: (1) That the surgical operation that I propose is designed for the correction of triquiasis, distriquiasis, and entropion of the upper eyelid. (2) I reached this object unexpectedly whilst trying to perform tarsoplasty according to Professor Gayet's method. (3) I find the reason of the success in the absence of fixed insertions in the external extremity of the orbicular muscle. (4) In certain cases of distriquiasis, the eyelashes grow in a wrong direction, and, when fully developed, they rest against the border of the inferior eyelid. (5) Patients with granulations who had not been able for a long time to perform their duties are enabled after the operation to resume their work. (6) I feel satisfied that a greater number of operations will bring new modifications to the preceding, which is already greatly simplified.

A CASE OF CYSTICERCUS OF THE VITREOUS.

By W. CHEATHAM, A. B., M. D., of Louisville, Ky.

This affection being so rare in America, England, France, and countries other than Northern Germany, I feel justified in reporting a case that has come under my observation this week.

Mrs. F., aged 42, of Irish parentage, consulted me May 22, 1893, concerning her left eye. January last she had some severe acute inflammation of her left eye in which there was intense pain and edema of the lids, which lasted for some weeks. She now has vision of left eye $\frac{15}{40}$, with no improvement by glasses. She has some scars of upper part of cornea simulating those found in trachoma, with slight pannus. I was surprised on everting the lid to find no indication of her ever having had trachoma. Vision right eye $\frac{8}{200}$, and eccentric. She said her right eye had been blind (following a spell of sickness) since she was 15 years old, or twenty-seven years. She did not come to consult me concerning her right eye, yet as a matter of routine I examined it. I found all the media perfectly clear. Just at or over right macula I discovered a sac or cyst, pedunculated, the pedicle being attached to the retina above and external to the macula, the body of the sac

extending down and in over the region of the macula. The sac with its pedicle appeared a bluish gray and opaque, except a part of the wall toward me about the size and shape of the optic nerve entrance, which was transparent and through which the deeper or other wall could be seen. The eye was emmetropic with the ophthalmoscope. The highest or most prominent part of the sac, just at the transparent part referred to, could be seen best with a + 10 D., showing an elevation of about 2.3 mm. The other cyst wall could be seen through this transparent portion best with about a + 2 D., showing an elevation of about 0.52 mm. The sac was ovoid in shape with the edges at some points serrated, and at one point down and in there was quite a projection. Over this sac small blood vessels could be seen, one up and in could be traced to a large retinal vessel close by. No motion could be discovered in this opaque cyst. Forming something of a crescent from the lower and outer part of this sac was a transparent, reddish cyst; at the upper part of this cyst could be seen two spots looking like air bubbles, which were no doubt the parasite's suckers. This cyst when watched closely could be seen to have a distinct rhythmical motion; a spot of pigment beneath it would appear and disappear; the motion was perfect. Above the attachment of the pedicle of the cyst could be seen two white, crescent-shaped spots, no doubt the points of entrance of the parasite. The retina between the cyst and optic nerve presented the appearance of a recent detachment. Several large vessels ran from the nerve direct to the sac, some of them disappearing under it and reäppearing on the other side. There were many more large vessels taking this course than usual. This would probably indicate that the trouble is of long standing. The vitreous seemed to be detached over the optic nerve entrance. I called Drs. Dabney and Pusey, of this city, to see the case, on account of its rarity and interest, and to confirm my diagnosis, which they both did.

Mrs. F. gives a history of several serious attacks of what she called congestion of heart and lungs, several years ago. For six or seven years up to January last, when her left eye was so badly inflamed, her health had been very good. She thinks she is going through her "change." Left eye usually inflamed some every four weeks. This case, besides being the second, so far as I know of, reported in America, presents other points of interest. Could this parasite possibly have been the original cause of the loss of vision of right eye twenty-seven years ago? I think this possible and quite probable. The vitreous is clear and but little damaged, but a small part of the retina and choroid are damaged. The parasite, from the appearance of the parts, seems to have left its old bed, and is migrating. Mrs. F. does not remember of ever having had any pain in her right eye. Could the disease she has had in her left eye be sympathetic? Sympathetic affections have their exacerbations and their times of quiet, as we all know.

Foster, Encyclopedic Medical Dictionary, page 1237, says:

Cysticercus cellulosa is the larval stage of tænia solium. It has a quadrangular head, a long cylindrical body, and an elliptical, caudal vesicle, and is from 10 to 15 mm. in length.

Manthuer describes the animal as follows:

The worm is provided at its posterior end with a round cyst-like formation which acts as the receptaculum scolicis, into which the animal can withdraw, presenting when in this position the appearance of a round, whitish body. A small hole marks the mouth of this small receptacle. When the animal protrudes its head and neck out of the receptacle its body appears to be sprinkled here and there with calcareous deposits, and presents sometimes a smooth and sometimes a wrinkled surface. The body decreases in size toward the neck, to which is attached the head, with its four flattened down but angular projections. A round-shaped snout can be projected by the animal from the center of its head, and this latter is provided at its base with a double row of hook-like tentacles, which are capable of retraction. Each of the angular projections of the head is, moreover, provided with a rounded sucking apparatus.

Schmidt-Rimpler, page 276, says:

The embryo enters the stomach of the suitable host in the food or water, loses its covering through the action of the gastric juice, bores into the blood vessels with its hooks, and begins to wander. Finally it becomes settled, and now begins the second stage of its development in which it is known as cysticercus. It is converted into a vesicle with fluid contents. All authors agree that the embryo tarvels by the blood current. Cysticerci may occur in any part of the eye or orbit. They have been seen in the orbit, lids, conjunctiva, iris, lens, vitreous, choroid, and retina. They are found more often in the posterior part of the eyeball than in the

anterior. They are quite common in Northern Germany, where uncooked meats are eaten; less often in Southern Germany, France, and Italy. There have been three cases reported in Austria. Brudenell Carter says none have been seen in England, but Soelberg Wells reports a case in his book, page 328. In Northern Germany, Graefe saw 80 cases in 80,000 patients, or 1 in 1,000 in the deeper tissues of the eye, 3 in the anterior chamber, 5 beneath the conjunctiva, and 1 in the orbit. Hirschberg in six months saw 2,100 new patients, in 5 of which he saw cysticercus, or 1 in 420 cases of eye diseases.

Of the one other case seen in this country, reported by Dr. Minor, Loring, on page 188, says:

From the opthalmoscopic appearances there was reason to believe that it was a true case of cysticercus, although it was not absolutely proved to be so.

Yet, from Dr. Minor's description of the case and the ophthalmoscopic appearances (page 193, Loring), I do not think there can be any doubt of its having been a case of cysticercus cellulosæ. How long a cysticercus can remain in an eye is in doubt. Cases of two and four years' standing are common. Von Graefe saw a case in 1856, which was twenty years afterwards seen intact by Hirschberg. Others have reported cases of long standing with vision nearly perfect. My case, as I stated before, is possibly of twenty-seven years' standing. Usually, though, in from fifteen to twenty months, irido-cyclo-choroiditis follows, and sometimes panophthalmitis, with total loss of the eye. Von Graefe and Hirschberg state that there is not much danger of sympathetic inflammation, although sympathetic irritation is often present. Jacobson reports sympathetic amblyopia. Two cysts have been seen in one eye, but no case has been reported of both eyes being involved. Patients with cysticercus do not have tape-worm. The presence of this parasite in the eye is so dangerous to the vitality and the usefulness of the organ that its removal has been undertaken and with success, but not with very flattering after results when it is located in the posterior part of the organ. When in the iris a section of this membrane that holds the parasite can be removed.

RELACIONES DE LA OFTALMOMETRÍA CON LA SKIASCOPIA.

Por el Doctor PEDRO LAGLEYZE,

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Kohlrausch, en 1839, propuso determinar el sitio del astigmatismo mediante las medidas comparativas de las imágenes reflejadas por la córnea. Senff, en 1846, emprendió este estudio, pero es en realidad Helmoltz quien, en 1854, demostró la importancia de este método midiendo las curvaturas de la córnea y del cristalino.

El oftalmómetro de Helmoltz, precioso instrumento matemático para las medidas fisiológicas, no es aplicable en la práctica diaria de la clínica. Javal y Schiötz, en 1881, construyeron un aparato basado sobre los mismos principios, adaptándolo á la clínica por un fácil manejo y haciendo innecesarios los cálculos matemáticos que exije el oftalmómetro de Helmoltz.

La oftalmometría descubre astigmatismos que escapan al más prolijo exámen por los métodos ordinarios, y cuando se ha usado durante algun tiempo el oftalmómetro de Javal, es difícil hacer optometría sin este precioso instrumento, que sin titubear, y con gran exactitud nos indica el rayo de curvatura de los meridianos principales de un astigmatismo en menos de un minuto.

Este instrumento es casi imprescindible para el clínico, pues sin él, no es posible descubrir en el astigmatismo total, la parte de refracción astigmática, dinámica ó estática, que pueda corresponder al cristalino; cuestion importante para la prescripción de lentes.

Cuando el astigmatismo total sea igual al córneo, no debe titubearse en indicar el cilindro que haga la correccion total. Si el astigmatismo total es mayor que el de la córnea, deberá tenerse en cuenta para la prescripción del cilindro no sólamente la

relación entre la diferencia refringente, sino también la dirección del meridiano córneo de menor rayo con la dirección del astigmatismo total.

De igual modo se procederá cuando el astigmatismo total sea menor que el indicado por el oftalmómetro. Débese siempre buscar con cuidado si estas diferencias son debidas á contracciones parciales del músculo ciliar, y guiarse para la corrección de tal manera que el vidrio no sea causa de que esta contracción irregular se mantenga, debiendo, por el contrario, dirigir todos los esfuerzos á fin de que desaparezca.

Cuando estas diferencias sean pronunciadas y principalmente si la mayor refringencia tiene lugar sobre el meridiano horizontal, será conveniente medir la refracción total bajo la acción atropínica y comparar el resultado.

Algunos autores sostienen que los resultados obtenidos por el oftalmómetro de Javal y Schiötz señalan vidrios superiores al exámen subjetivo. Oswalt es uno de los que sostienen esta tesis, pero su trabajo carece de valor porque no se basa en la práctica y porque parte de una premisa falsa sobre el valor dióptrico del ojo. Los doctores Motais, Pflatz y G. J. Bull dicen igualmente que en la gran mayoría los pacientes no admiten el cilindro indicado por el oftalmómetro, sino solamente un cilindro más débil. Story dice que los vidrios indicados por el oftalmómetro son media dióptria más fuertes que el astigmatismo subjetivo. Chibret sostiene lo contrario diciendo que, según sus trabajos de control por la skiascopia, el oftalmómetro da numeros menores en lugar de aumentarlos. Tscherning y Javal han demostrado, el primero científicamente y el segundo por la clínica, que en los fuertes grados el astigmatismo subjetivo es generalmente superior al indicado por el oftalmómetro.

No se pueden hacer conclusiones generales sin indicar la dirección de máxima curvatura de la córnea, pues el astigmatismo total varía según esta inclinación. Javal ha estudiado desde 1880 hasta el año 1887 las relaciones que existen entre el astigmatismo total y el astigmatismo de la córnea, habiendo llegado á las siguientes conclusiones:

El astigmatismo regular comprende á lo menos tres especies distintas.

Una de ellas se presenta en general en los ojos cuyo meridiano vertical presenta la mayor curvatura. La segunda se encuentra habitualmente en aquellos en que el astigmatismo está colocado en una dirección perpendicular á la del caso precedente.

En fin, la tercera variedad se encuentra más amenudo en los ojos en que los meridianos están situados en 45 grados.

En la primera de estas variedades, la más ordinaria, la totalidad del achaque reside en la córnea, ó sea el astigmatismo total difiere poco del astigmatismo córneo.

En la segunda, la deformidad reside principalmente en el cristalino, de tal manera que el astigmatismo total es superior al astigmatismo córneo.

Desde luego, cuando tengais que dar vidrios á enfermos de esta categoría, no debeis sorprenderos de encontrar amenudo una ó dos dióptrias de astigmatismo cristaliniano estático.

Es entre los ojos de esta categoría que se reclutan en masa el glaucoma y la catarata.

La tercera variedad que se encuentra más amenudo en los ojos cuyos meridianos forman ángulos de 45° con la vertical, no se asemeja á las precedentes. Se acompaña de una descentración del globo que puede llegar hasta 20 y 25°. Aquí los vidrios correctores no corrijen sino mediante una visión oblicua. (Soc. franç. d'opht. Congr. de 1887. Sess. 2 mai.)

Swan Burnet dice que el oftalmómetro da cifras mayores para el astigmatismo según la regla y más débiles para el contrario á la regla, creyendo que esto último es debido á una inclinación del cristalino. El error en ambos casos, dice, que es de 0.50 D. y que una diferencia mayor entre el exámen oftalmométrico y el subjetivo indica la instilación de un midriático para deslindar las contracciones parciales del músculo ciliar del astigmatismo estático. (Washington, Congr. Soc. médica americana, Mayo, 1891.)

La corrección útilmente aplicable al astigmatismo está generalmente comprendida entre las indicaciones oftalmométricas y skiascópicas. El resultado subjetivo se acercará lo más amenudo al astigmatismo oftalmométrico en los casos de astigmatismo según la regla, y al astigmatismo skiascópico en los casos que el astigmatismo sea contra la regla.

No debe pedirse al oftalmómetro más de lo que puede dar. Si el vidrio se llevara pegado sobre la córnea, y si no se tuviera en cuenta al agente cristaliniano, que en general no altera en mucho el resultado, el oftalmómetro indicaría la prescripción del vidrio. Pero no debe olvidarse lo que para muchos observadores ha pasado sin importancia, que el oftalmómetro indica el astigmatismo córneo y no el vidrio corrector; para hallar su justo valor es necesario tener en cuenta la distancia que separa al anteojo de la córnea. Esta distancia negligible para los débiles grados, y en general para los astigmatismos simples, debe de tenerse muy en cuenta para los astigmatismos compuestos.

Esta es una de las causas que debe señalarse como una de las más frecuentes y poderosas en las diferencias del astigmatismo total y córneo.

A continuación presento una série de cuadros comparativos que demuestran las diferencias indicadas entre el exámen oftalmométrico y skiascópico, correspondientes á cada grupo, y ordenados según la variedad del astigmatismo y la dirección del meridiano más refringente.

Los signos (+) y (—) indican la relación del meridiano más refringente entre las medidas encontradas por el oftalmómetro y la skiascopia. El signo (+) señala el exceso oftalmométrico sobre el skiascópico, y el signo (—) el de la skiascopia sobre el oftalmómetro.

Este trabajo se basa sobre el estudio analítico de 1,230 ojos examinados durante el año 1891. En todos he medido la refracción total por medio de la skiascopia, y el rayo de curvatura de la córnea con el oftalmómetro de Javal y Schiötz.

El aparato que he usado para la medida de la córnea es el ejemplar No. 123, construido por A. Goubeaux, con las últimas modificaciones de Javal, es decir, con el raro grado de perfección que posee desde el año 1889.

Diferencia entre el astigmatismo indicado por el oftalmómetro y la skiascopia.

ASTIGMATISMO MIÓPICO SIMPLE.

Meridiano vertical más refringente.		Meridiano oblicuo más refringente.		Meridiano horizontal más refringente.		Meridiano vertical más refringente.		Meridiano oblicuo más refringente.		Meridiano horizontal más refringente.	
No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.
	D.		*D.*		*D.*		*D.*		*D.*		*D.*
53	0.00	4	0.00	8	0.00	17	—0.50	3	—0.50	1	—0.75
6	+0.25	1	+0.25	3	—0.25	1	—0.75	1	—0.75	1	—1.25
5	+0.50	1	—0.25	2	—0.50	4	—1.00	2	—1.00	1	—1.50
2	+0.75	.....	.....	.....	.....	2	—2.00	.....	.....	.....	.....
11	—0.25	.....	.....	.....	.....						

ASTIGMATISMO MIÓPICO COMPUESTO.

66	0.00	12	0.00	26	0.00	5	—1.25	2	—0.75	8	—1.00
4	+0.25	1	+0.25	5	+0.25	17	—1.50	2	—1.00	3	—1.25
7	+0.50	1	+1.00	4	—0.25	14	—2.00	2	1.50	3	—1.50
2	+1.00	4	—0.25	16	—0.50	6	—2.50	1	—2.50	2	—2.00
2	+1.50	4	—0.50	1	—0.75	1	—2.75	.....	.....	1	—2.50
1	+1.75	.....	.....	.....	.....	3	—3.00	.....	.....	.....	.....
10	—0.25	.....	.....	.....	.....	3	—3.50	.....	.....	.....	.....
41	—0.50	.....	.....	.....	.....	1	—4.00	.....	.....	.....	.....
7	—0.75	.....	.....	.....	.....	1	—5.00	.....	.....	.....	.....
26	—1.00	.....	.....	.....	.....						

ASTIGMATISMO HIPERMETRÓPICO SIMPLE.

68	0.00	8	0.00	6	0.00	8	—0.25	1	—0.50	1	—0.50
11	+0.25	1	+0.50	2	—0.25	5	—0.50	1	0.75	.....	.....
4	+0.50	1	—0.25	.....	.....	2	—1.25	.....	.....	.....	.....
1	+1.00	.....	.....	.....	.....						

Diferencia entre el astigmatismo indicado por el oftalmómetro y la skiascopia—Continúa.

ASTIGMATISMO HIPERMETRÓPICO COMPUESTO.

Meridiano vertical más refringente.		Meridiano oblicuo más refringente.		Meridiano horizontal más refringente.		Meridiano vertical más refringente.		Meridiano oblicuo más refringente.		Meridiano horizontal más refringente.	
No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.
	D.		D.		D.		D.		D.		D.
69	0.00	11	0.00	11	0.00	9	—0.50	4	—0.25	4	—0.50
17	+0.25	1	+0.25	1	+0.25	3	—0.75	2	—0.50	1	—0.75
15	+0.50	2	+0.50	2	+0.50	10	—1.00	1	—0.75	2	—1.00
1	+0.75	1	+1.00	3	—0.25	2	—1.50	3	—1.00	.....	.....
5	+1.00	.....	.....	.....	.....	1	—2.00	.....	.....	.....	.....
17	—0.25	.....	.....	.....	.....	1	—3.00	.....	.....	.....	.....

ASTIGMATISMO MIXTO.

28	0.00	9	0.00	2	0.00	1	—1.25	1	—1.00	1	—1.00
2	+0.25	1	+1.00	2	+0.50	4	—1.50	.....	.....	1	—2.00
1	+0.50	.....	.....	1	—0.50	12	—2.00	.....	.....	2	—2.50
1	+1.00	.....	.....	1	—0.75	1	—2.25	.....	.....	1	—3.00
2	—0.25	.....	.....	.....	.....	2	—2.50	.....	.....	.....	.....
11	—0.50	.....	.....	.....	.....	1	—3.00	.....	.....	.....	.....
2	—0.75	.....	.....	.....	.....	1	—4.00	.....	.....	.....	.....
15	—1.00	.....	.....	.....	.....						

El oftalmómetro no indica astigmatismo y la skiascopia, sí.

EN OJOS HIPERMÉTROPES.

Meridiano vertical más refringente.		Meridiano oblicuo más refringente.		Meridiano horizontal más refringente.		Meridiano vertical más refringente.		Meridiano oblicuo más refringente.		Meridiano horizontal más refringente.	
No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.
	D.		D.		D.		D.		D.		D.
2	—0.50	.....	.....	2	—0.50	5	—1.00		.....	2	—1.50
2	—0.75	.....	.....	1	—0.75	.....	.....	.....	.....	1	—2.00
.....	.....	.....	.....	2	—1.00						

EN OJOS MIOPES,

1	—0.75	3	—1.00	1	—0.50	1	—2.00	.....	.....	4	—1.00
7	—1.00	.....	.....	3	—0.75						

El oftalmómetro indica astigmatismo y la skiascopia, no.

EN OJOS HIPERMÉTROPES.

Meridiano vertical más refringente.		Meridiano oblicuo más refringente.		Meridiano horizontal más refringente.		Meridiano vertical más refringente.		Meridiano oblicuo más refringente.		Meridiano horizontal más refringente.	
No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.	No. de ojos.	Diferencia.
	D.		D.		D.		D.		D.		D.
44	+0.25	3	+0.25	3	+0.25	4	+0.75	2	+0.50	2	+1.00
31	+0.50	.....	.....	2	+0.50	8	+1.00	.....	.....	.....	.....

EN OJOS MIOPES.

29	+0.25	1	+0.25	2	+0.25	4	+0.75	1	+0.75	1	+0.75
14	+0.50	6	+0.50	6	+0.50	3	+1.00	3	+1.00	1	+1.50

EL OFTALMÓMETRO Y LA SKIASCOPIA NO REVELAN ASTIGMATISMO EN 153 OJOS AMETRÓPICOS.

Lo que más resalta en estos cuadros es que el valor del astigmatismo indicado por la skiascopia prevalece sobre el valor refringente correspondiente á la medida de la córnea, principal sitio del astigmatismo.

El cuadro que sigue demuestra el término medio para cada variedad de astigmatismo. Todos representan una cantidad negativa para el oftalmómetro con excepción del último grupo, en el cual el astigmatismo córneo se halla corregido por un astigmatismo inverso del cristalino, ocultándolo por completo.

Relación media entre la oftalmometría y la skiascopia según la variedad del astigmatismo y la dirección del meridiano más refringente.

	No. de ojos.	Media.		No. de ojos.	Media.
Astigmatismo miópico simple:		D.	Astigmatismo hipermetrópico compuesto:		D.
Meridiano vertical	101	—0.14	Meridiano vertical	150	—0.07
Meridiano oblicuo	12	—0.35	Meridiano oblicuo	25	—0.14
Meridiano horizontal	16	—0.32	Meridiano horizontal	24	—0.17
Astigmatismo miópico compuesto:			Astigmatismo mixto:		
Meridiano vertical	217	—0.67	Meridiano más refringente vertical	84	—0.78
Meridiano oblicuo	29	—0.37	Meridiano más refringente oblicuo	11	.00
Meridiano horizontal	69	—0.45	Meridiano más refringente horizontal	11	—1.02
Astigmatismo hipermetrópico simple:					
Meridiano vertical	99	—0.01			
Meridiano oblicuo	12	—0.08			
Meridiano horizontal	9	—0.11			

El oftalmómetro no indica astigmatismo y la skiascopia, sí.

	No. de ojos.	Media.
Hipermétropes:		
Meridiano más refringente—		D.
Vertical	9	—0.83
Horizontal	8	—1.09
Miopes:		
Meridiano más refringente—		
Vertical	9	—1.08
Oblicuo	3	—1.00
Horizontal	8	—0.84

El oftalmómetro indica astigmatismo y la skiascopia, no.

	No. de ojos.	Media.
Hipermétropes:		
Meridiano más refringente—		D.
Vertical	87	+0.43
Oblicuo	5	+0.35
Horizontal	8	+0.53
Miopes:		
Meridiano más refringente—		
Vertical	50	+0.40
Oblicuo	11	+0.63
Horizontal	10	+0.57

El estudio de este cuadro demuestra que cada grupo presenta sus meridianos oscilando próximamente al rededor de una misma cifra. El meridiano oblicuo del astigmatismo mixto hace excepción á esta regla general.

Dice Javal que cuando subjetivamente existe astigmatismo y el oftalmómetro no lo revela, el astigmatismo es contrario á la regla. Mis resultados no están contestes con los de Javal. Tanto el meridiano horizontal como el vertical se hallan casi en

igual número en ojos miopes como en hipermétropes; el meridiano oblicuo solo en muy pequeño número de miopes y en ningún hipermétrope.

He aquí, para cada grupo, el valor medio de las diferencias entre las medidas oftalmométricas y skiascópicas:

	No. de ojos.	Média.
		D.
Astigmatismo miópico simple	129	—0.18
Astigmatismo miópico compuesto	315	—0.60
Astigmatismo hipermetrópico simple	120	—0.02
Astigmatismo hipermetrópico compuesto	199	—0.09
Astigmatismo mixto	106	—0.72

El oftalmómetro no indica astigmatismo y la skiascopia sí, en 37 ojos; media —0.96 D.

El oftalmómetro indica astigmatismo y la skiascopia, no en 171 ojos; media +0.44 D.

Los valores de la diferencia media según la inclinacisn del meridiano más refringente, incluyendo todas las variedades del astigmatismo, son:

	D.
En 806 ojos con el meridiano vertical más refringente	—0.28
En 108 ojos con el meridiano oblicuo más refringente	—0.12
En 163 ojos con el meridiano horizontal más refringente	—0.35

Si de los 1,230 ojos descontamos 153 ametrópicos, en los cuales el oftalmómetro y la skiascopia no han revelado astigmatismo, tendremos 1,077 ojos de un astigmatismo próximamente de 0.25 D. no verificado por el oftalmómetro.

Proporción centecimal del número de astigmáticos según su variedad y meridiano de mayor refringencia en el astigmatismo total.

	Vertical.	Oblicuo.	Horizontal.	Total.
Astigmatismos indicados por el oftalmómetro y la skiascopia en el meridiano:				
Astigmatismo miópico simple	9.38	1.11	1.49	11.98
Astigmatismo miópico compuesto	20.15	2.69	6.41	29.25
Astigmatismo hipermetrópico simple	9.19	1.11	0.84	11.14
Astigmatismo hipermetrópico compuesto	13 92	2.32	2.23	18.47
Astigmatismo mixto	7.80	1.02	1.02	9.84
Astigmatismos no indicados por el oftalmómetro y sí, por la skiascopia:				
Astigmatismos hipermetrópicos	0.84	.....	0.74	1.58
Astigmatismos miópicos	0.84	0.28	0.74	1.86
Astigmatismos indicados por el oftalmómetro y no por la skiascopia:				
Astigmatismos hipermetrópicos	8.08	0.46	0.74	9.28
Astigmatismos miópicos	4.64	1.02	0.93	6.59
Total	74.84	10.03	15.13	100.00

Estos números comparativos han sido deducidos de una cantidad de 1,077 astigmáticos totales, ellos demuestran proporcionalmente sobre cada cien casos, la relación de las diversas variedades de astigmatismos y de la inclinación de los meridianos de mayor refringencia.

Las cifras de este cuadro conducen á las siguientes conclusiones:

1ª. Las sumas de astigmatismos simples descubiertos por el oftalmómetro y la skiascopia, revelan entre sí una diferencia tan pequeña que, sin gran error, pueden considerarse iguales.

Descomponiendo el astigmatismo simple según los meridianos de mayor refringencia, tendremos:

(*a*) El meridiano vertical presenta un número igual de astigmatismos simples hipermetrópicos y miópicos;

(*b*) El meridiano oblicuo se manifiesta en una justa é igual cantidad;

(*c*) El meridiano horizontal acusa una notable diferencia en favor del astigmatismo miópico simple, siendo casi dos veces más numeroso que el astigmatismo hipermetrópico simple;

(*d*) Las sumas del astigmatismo hipermetrópico y miópico simple en sus meridianos oblicuos, lo mismo que en el horizontal, se presentan en igual número de casos, siendo la suma del meridiano vertical de ámbos astigmatismos simples ocho veces más frecuente que la suma de cada uno de los otros dos meridianos.

2ª. Las sumas de astigmatismos compuestos, indicados por el oftalmómetro y la skiascopia, se hallan en la proporción de cien astigmatismos miópicos compuestos para cada 63 astigmatismos hipermetrópicos.

Los meridianos del astigmatismo compuesto entre los miópicos é hipermetrópicos, se encuentran en la siguiente proporción:

(*a*) El meridiano vertical prepondera en los miópicos, siendo de casi $\frac{3}{2}$ la proporción de astigmatismos miópicos compuestos con relación á los hipermetrópicos;

(*b*) El meridiano oblicuo ligeramente superior para los miópicos da más ó menos $\frac{2}{3}$ en la proporción con los hipermetrópicos, exceso que puede negligirse aceptando como conclusión: igual número de astigmatismos compuestos miópicos é hipermetrópicos para el meridiano oblicuo;

(*c*) El meridiano horizontal tiene en el astigmatismo compuesto una diferencia más notable que la indicada por el astigmatismo simple, siendo tres veces más frecuente en el astigmatismo miópico compuesto que en el hipermetrópico;

(*d*) La relación de los meridianos según su inclinación no es igualmente proporcionada en el astigmatismo miópico compuesto que en el hipermetrópico. El meridiano vertical del astigmatismo miópico compuesto es poco más de siete veces más frecuente que el oblicuo, y solo tres veces más frecuente que el horizontal. El meridiano vertical del astigmatismo hipermetrópico compuesto es seis veces más numeroso que el oblicuo y también que el horizontal;

(*e*) Las sumas de los meridianos correspondientes del astigmatismo miópico compuesto é hipermetrópico da para el meridiano vertical una frecuencia dos veces y media mayor que los otros dos meridianos juntos. Siendo el meridiano vertical casi siete veces más numeroso que el oblicuo, y cuatro más que el horizontal.

3ª. El astigmatismo mixto, descubierto por el exámen oftalmométrico y skiascópico ha revelado que el meridiano vertical más refringente se presenta siete veces y media más frecuentemente que cada uno de los otros meridianos, hallándose los meridianos oblicuo y horizontal en igual número de casos.

4ª. El oftalmómetro no ha revelado astigmatismo mientras que la skiascopia ha indicado asimetría en la refracción ocular, provocada por el cristalino solamente, en un caso para cada 29 astigmatismos:

(*a*) La cantidad de astigmatismos hipermetrópicos, pueden considerarse como igual á la de astigmatismos miópicos indicados por la skiascopia y no por el oftalmometro.

(*b*) El meridiano vertical se ha presentado igual número de veces en los ojos hipermetropes y miopes, lo mismo ha sucedido con el horizontal.

(*c*) El meridiano oblicuo no se ha manifestado en ningún astigmatismo hipermetrópico, y tan rara vez en ojos miópes (1 por 359 astigm.), que puede darse como regla general la falta de astigmatismo cristaliniano en los meridianos oblicuos.

(*d*) El meridiano vertical es $\frac{9}{2}$ veces más frecuente que el horizontal.

5ª. El oftalmómetro ha indicado sin que la skiascopia revele astigmatismo un número de ojos cuatro y media veces mayor que en el caso anterior. La skiascopia no descubre la asimetría porque el astigmatismo córneo se halla corregido por un astigmatismo inverso del cristalino:

(*a*) La cantidad de astigmatismos hipermetrópicos es de $\frac{4}{3}$ con relación al número de astigmatismos miópicos.

(*b*) El meridiano vertical más refringente se presenta en mayor número en los astigmatismos hipermetrópicos, siendo casi el doble de los miópicos.

(*c*) El meridiano oblicuo es la mitad menos frecuente en los hipermetrópicos.

(*d*) El meridiano horizontal se presenta en los $\frac{4}{5}$ de hipermetrópicos con relación al mismo meridiano en los miópicos.

6ª. La relación de los meridianos entre sí, de la suma total de todos los astigmatismos clasificados en el cuadro centecimal, es:

Para el meridiano vertical	74.84
Para el meridiano oblicuo	10.03
Para el meridiano horizontal	15.13

De tal manera, que el astigmatismo según la regla, es decir el vertical, es siete veces y media más frecuente que el oblicuo, y cinco veces más que el llamado contrario á la regla, ó sea el horizontal, siendo este último una vez y media más frecuente que el oblicuo.

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ADDRESS BY THE PRESIDENT OF THE SECTION, E. FLETCHER INGALS, A. M., M. D.

Gentlemen and Colleagues: In calling to order the laryngological section of the Pan-American Medical Congress I take the opportunity to congratulate you upon the number and excellence of the papers which have been secured for your consideration. I feel that there is a special reason for felicitation upon the propitious circumstances under which we have convened, because of our success in spite of many obstacles. The laryngologists of this country, as well as those who would have visited us from abroad, have been called upon for more than the usual amount of work during the past few months. Early in May the American Laryngological Association met in New York and was largely participated in by those who other-

wise would have been free to aid us. Shortly afterwards the American Climatological Association met in Philadelphia, taxing the energy and taking the time of many of the laryngologists of this country. And only three weeks subsequently the American Medical Association met in Milwaukee, with a large attendance upon the laryngological section. In addition to these, the various State medical societies called out a considerable number of papers upon diseases of the throat and nose. Besides this, many laryngologists who contemplate going abroad have undertaken to prepare papers for the International Medical Congress, which was to have met in Rome shortly after the close of this congress.

When the American Laryngological Association held its first annual meeting in 1879 there were, all told, less than thirty men in the United States sufficiently interested in the subject to be counted laryngologists. But the ranks have been added to rapidly year by year, until now there are probably not less than four times that number who are well equipped; and in all of the cities and larger towns throughout the country are others more or less qualified who are doing considerable work in this special line, and it is probable that to-day 500 men could be found in the United States who might present something of interest to this body, though I have been able to discover only about 200 of them.

Nearly a year ago I opened correspondence with the physicians of Central and South America and the West Indies, hoping to get them to join us in this congress, but I regret to say that in only a few instances have I been able to obtain replies to my letters, and that only two or three of our colleagues in those countries have promised papers for this occasion. Considering the limited intercourse which has always existed between the United States and the Latin Americas, this is not a matter of surprise, but it is hoped that this congress will be a beginning of a closer alliance and personal friendships, which will, in coming years, bring us often together, and build up a powerful International Congress in this Western Hemisphere.

The railroad already projected through Central America, which will connect with various railroad systems in South America, and increased means of communication by sea, will, it is believed, ere long, open up to the physicians of the United States many new and valuable resorts whose climatic influences may be made subservient to our patients in their search for health. When this has been brought about it is obvious that our acquaintance with the physicians in these southern climes will be of the greatest advantage to our patrons.

We welcome you one and all to our national capital. We ask of each your hearty coöperation in the work before us, and we believe the final results will justify the large amount of labor and anxiety which have been expended in this undertaking.

PAPERS READ BEFORE THE SECTION.

REFLEX EPILEPSY FROM INTRA-NASAL DISEASE.

By JOHN O. ROE, M.D., of Rochester, N.Y.

The existence of reflex neuroses has been known since the earliest period of medical history. In an excellent historical study on this subject, read before the American Laryngological Association in 1887, Mackenzie[1] traces the general history of such neuroses from the time of Plato and Aristotle to that of Bostock, in the second decade of this century. Of the neuroses that may be excited by peripheral irritation probably epilepsy is the most important; for, as Watson[2] very truly says:

> While it is a disease probably not painful in itself, seldom immediately fatal, often recovered from altogether, it is yet apt, in many cases, to end in fatuity or insanity, and carries perpetual anxiety and misery into those families which it has once visited.

It was called the "sacred" disease by the ancients—"either," as Aretæus[3] says, "from its magnitude (for what is great is sacred) or from the cure not being in the power of man, but of God, or from the notion that a demon has entered the patient, or from all put together."

The earliest conception of the malady was that it is a disease of the brain, and incurable. Aretæus seems, however, to have recognized that the exciting cause may reside in other parts, for he says:

> Occasionally the malady is fixed in the head, and that is the starting point of the paroxysms; in other cases it begins in the nerves which are most remote from the head and which sympathize with the part affected.

The nose seems to have been the part of the body which was first recognized to be so vulnerable to external influences as to excite epileptic attacks. Mackenzie[4] says that among the older writers many cases are recorded in which the odor of various substances was known to result in epilepsy; and Salmuth,[5] in 1648, called attention to the fact that paroxysms of epilepsy are often relieved by the eruption of blood from the nose. Since that time, irritation of nearly every part of the body has been observed to be the cause of epileptic convulsions. The first scientific light was thrown upon this subject about forty years ago by Brown-Séquard,[6] who showed by a series of carefully conducted experiments on animals that epilepsy could be produced by the artificial irritation of the peripheral nerves in almost any part of the body. The first experimenter, however, to formulate a distinct physiological theory of epilepsy was Marshall Hall.[7]

According to Marshall Hall the seat of epilepsy is in the medulla oblongata. To fully understand his system one must remember that this medulla oblongata, the seat of reflex or excito-motor movements, has the power of receiving impressions conveyed by the sensory nerves, which act as centripetal conductors, and also possesses the power of transferring them to the muscular system by the

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[1] Transactions of American Laryngological Association, 1887, p. 102.

[2] Practice of Physic, Philadelphia, 1853, p. 379.

[3] Causes and Signs of Chronic Diseases, Liber primus, cap. IV.

[4] Transactions of American Laryngological Association, 1887, p. 106.

[5] Observationum medicarum centuriæ tres posthumæ, Brunsvigiæ, 1648, cent. II; obs. 13, p. 65; and obs. 60, p. 87.

[6] Researches on Epilepsy; its Artificial Production in Animals, etc., Boston, 1857.

[7] See T. Falret, Théories Physiologiques de l'Épilepsie; in Archives général de Médecine, February to May, 1862.

motor nerves, which act as centrifugal conductors. If the medulla oblongata, being morbidly excited, experiences a stimulus either from the brain or periphery, such stimulus will be abnormally transmitted to the muscular system, and reflex movements of greater or less irregularity and violence will be produced.

Brown-Séquard accepted Marshall Hall's theory in general, and developed it with remarkable ability in a large number of papers. Accordingly it was generally received until 1870, when the question assumed another aspect.

It was in that year that Fritsch and Hitzig[1] published their first researches upon the motor centers of the brain. By them it was demonstrated that mechanical irritation of certain regions of the cerebral cortex caused convulsions similar to those of epilepsy. Hitherto the most eminent physiologists had unanimously held that the brain was functionally homogeneous, and that stimulation of neither surface nor deeper parts would be followed by any motor reaction. The observations of Fritsch and Hitzig were, however, soon confirmed by a large number of experimenters. Without depriving the medulla oblongata of the function attributed to it by Marshall Hall and Brown-Séquard, it is thus clearly established that it has not the exclusive power of provoking epileptic convulsions. Thus we immediately have the question brought before us, Is there a difference between convulsions of cortical origin and medullary origin, and why are sometimes the former, sometimes the latter, produced? It is this question that Hughlings Jackson[2] endeavors to answer in the Lumleian Lectures for the year 1890. According to Jackson the central nervous system is composed of three superimposed levels, representing degrees of evolution more and more advanced. In each of these levels, the lower, middle, and upper, there is a set of cerebral convolutions. The lower level consists of the spinal cord, the medulla, and pons, and represents the simplest movements of all parts of the body. The middle level of the cerebral system is composed of centers in the Rolandic region (so-called "motor region" of the cerebral cortex), and possibly of the ganglia of the corpus striatum also. It represents complex movements of all parts of the body from eyes to perineum.

The upper level of the cerebral system is made up of centers of the prefrontal lobes. This represents the most complex movements of all parts of the body and presides over "epilepsy," properly so called. These three levels are all sensorimotor, and in each of them convulsions are produced by the same mechanism. To these anatomical classifications there is a corresponding classification of convulsions. These convulsions constitute genuine epilepsy only when they are of cerebral origin; that is, when they originate in the highest level; otherwise minor convulsive movements are manifested, such as petit mal. In order to explain the mechanism of the convulsion, Hughlings Jackson adopts Schroeder van der Kolck's[3] idea of comparing the nerve center to a Leyden jar, the convulsion to the discharge of the jar. He starts with this principle—that all nervous phenomena are to be traced to a nervous discharge, or liberation of the energy of the nervous elements. This discharge takes place in all healthy operations. When produced abnormally there results a discharge by explosion, and as a result convulsive movements of certain portions of the body that are in direct connection with the portion of the cortex irritated. Hence this form of epileptic manifestations, or hemiepilepsy, has been distinctly characterized as "Jacksonian epilepsy." The irritation in this case may be applied to the brain center itself, or may be reflected to it from some distant part. Hughlings Jackson goes so far as to say that there is "in every case of epileptic seizure a persistent discharging lesion," and that he would advise cutting out that lesion, whether it was produced by tumor or not.

[1] Reichert and Du Bois-Raymond's Archiv, 1870, No. 3.

[2] British Medical Journal, 1890, Vol. I, p. 703.

[3] On the Minute Structure and Functions of the Spinal Cord, etc.; translated by W. D. Moore. London, New Syd. Soc., 1859.

Hughlings Jackson's theory of cortical irritation has since been fully sustained by the brilliant achievements in brain surgery of Victor Horsley and Schäfer.[1] Macewen,[2] Ferrier,[3] Keen,[4] Lloyd and Deaver,[5] Mills,[6] Leo,[7] Bennett and Gould,[8] Barker,[9] Park,[10] Oliver,[11] Seguin and Weir,[12] and Harrison.[13]

As the most usual peripheral causes that may excite cortical irritation, manifested in epilepsy, may be mentioned diseases of the ear, teeth, eyes, uterine appendages, and the nose. Disease of the external or middle ear may in some cases be associated with reflex epilepsy, entirely independent of any direct involvement of the brain itself. Moos[14] reports a case of middle-ear disease which resulted in epileptic seizures. A large number of similar instances are recorded elsewhere by various writers. Elaborate researches on the relation of epilepsy to ear disease, when the disease acts as a causative factor, have been made by Boucheron[15] and Ormerod.[16] Ormerod tested the ears of 200 epileptic patients, and found that 31 of them had a previous history of suppurative otitis, past or present. As a counterstudy, 100 patients with ear disease were examined for epilepsy. Seven cases were found. Brubaker[17] has reported 16 cases of epilepsy due entirely to the presence of decayed teeth, and an interesting instance has also been reported by Schwartzkopff.[18] Other references to similar cases are given by Hare.[19]

G. Sous[20] reports a case in which relief from epileptic convulsions was obtained by the removal of a cataract, and Galezowski[21] records a case of epilepsy that was due to the reflex irritation produced by inflammation of the stump of an optic nerve after the eye had been removed. In 1876 Stevens,[22] of Albany, N. Y., said that in 70 cases of epilepsy examined by him only 3 were free from refractive lesions, and in 2 of these deep excavation of the optic nerve existed, a condition liable to give rise to a most troublesome form of asthenopia. At the same time he presented a table showing the refractive condition of the eyes in 54 cases of epileptic insane persons and in only a very small proportion of these cases was the vision normal.

As far back as 1698 Eickmeyer[23] published a work on uterine epilepsy, and two quartos appeared in 1764 on the same subject, one by Polex[24] and the other by Schneider.[25] In 1859 Eagon[26] reported a case of epilepsy succeeding the suppression

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[1] Phil. Trans. Royal Soc. of London, Vol. CLXXIX (1888), B, p. 1. The cases reported by Horsley individually are to be found in his brochure on Brain Surgery, from British Medical Journal, 1886, Vol. II, p. 670, and 1887, Vol. I, p. 863.

[2] Lancet, London, 1888, Vol. II, p. 254.

[3] Functions of the Brain.

[4] American Journal of the Medical Sciences, 1888, Vol. XCVI, p. 329.

[5] Ibid., p. 477.

[6] Transactions of Congress of American Physicians and Surgeons, 1888, Vol. I, p. 185.

[7] American Journal of Neurology and Psychiatry, 1883, Vol. II, p. 38.

[8] British Medical Journal, 1887, Vol. I, p. 12.

[9] Ibid., 1888, Vol. I, p. 777.

[10] Transactions of Congress of American Physicians and Surgeons, 1888, Vol. I, p. 324.

[11] British Medical Journal, 1888, Vol. I, p. 236.

[12] American Journal of the Medical Sciences, 1888, Vol. XCVI, p. 219.

[13] British Medical Journal, 1888, Vol. I, p. 848.

[14] Allgem. Zeitschrift f. Psychiatrie, Bd. XXXII, S. 5.

[15] Revue de Thér. Méd. Chir., September 1, 1886.

[16] Brain, 1884, p. 37.

[17] Medical and Surgical Reporter, Phila., 1888, Vol. LVIII, p. 67.

[18] Deutsches Monatshefte f. Zahnheilk., Heft 3, September, 1885.

[19] Epilepsy, its Pathology and Treatment. Philadelphia, 1890, p. 126.

[20] Journal de Médecine de Bordeaux, Tom. XVII, p. 202.

[21] Revue de Thér. Méd. Chir., 1886.

[22] Medical Record, New York, 1876, Vol. XI, p. 567.

[23] "De epilepsia uterina." Traj. ad Rhenum, 1698.

[24] "De epilepsia uterina." Jenae, 1764.

[25] "De epilepsia uterina." Erfordiae. 1764.

[26] American Journal of the Medical Sciences, 1859, n. s., Vol. XXXVIII, p. 569.

of the menstrual discharge and cured by the restoration of the catamenia. Curran[1] and Terrillon[2] have each recorded notes of cases of uterine epilepsy, and Thomas[3] has described a case of ovarian origin. In the instance mentioned by Engelmann[4] the epilepsy was dependent upon erosions of the cervix uteri, and the convulsions described by Carstens[5] were due to uterine stenosis.

Of instances of epilepsy whose origin may be traced to intra-nasal disease, 3 cases have been reported by De Vilbis.[6] In each of these cases the epilepsy was the result of so-called "nasal catarrh." Fincke[7] gives a full and very interesting report of a case in which the removal of nasal polyps gave complete relief from epileptic attacks, and Schneider[8] has cured 6 cases of epilepsy by the treatment of nasal disease. In some of the instances mentioned by Schneider, the epilepsy was complicated with attacks of asthma; in others there were no complications of any nature. Erlenmeyer[9] reports the case of a physician, 25 years old, who had an attack of influenza. About a month later he suffered from epileptiform convulsions, which Erlenmeyer believed to have resulted directly from the attack of influenza. Abramson[10] cured a girl who was suffering from nightly epileptic attacks by cauterization of hypertrophic rhinitis and enlargement of the turbinated bodies. Two cases of a similar nature are reported by Crossfield.[11] Griffin[12] removed a shoe button from the left nostril of a young girl suffering from epileptic convulsions, thus affording her instant relief. The button had become incrusted with the saline portions of the serum, and formed the nucleus of a rhinolith. The calculus was the size of a hazelnut. No medicine whatever was administered, nor were there any recurrences of the convulsions. Hinsdale[13] reports a case, given to him by Dr. Weir Mitchell, in which epilepsy was cured by the removal of a bean from the nose of the patient. In each of 2 cases observed by me and herewith reported, the epilepsy was the result of turbinated exostosis and hypertrophy, causing pressure on the septum.

Case 1.—Miss M., aged 23, was brought to me by her family physician, Dr. Townsend, of Bergen, N. Y., July 30, 1889. Her case presented the following history: One morning in February, 1888, she was found just recovering from a convulsive attack. Dr. Townsend was immediately summoned. As no one was present at the time when she was supposed to have fainted, the nature of the attack could not be made out. She was then well-nourished, had good color; all her functions, so far as could be ascertained, were normal. Suspecting that Miss M. had had a convulsion, Dr. Townsend instructed her parents to watch her closely. After the girl had three similar attacks alone, the fourth attack was observed by her mother, who described to the doctor the phenomena so well that there remained no doubt in his mind as to the true nature of the malady. It appeared that the patient was aware for many minutes previous that an attack was coming on, and could call her mother, who, in this instance, reached her before any convulsive effort had taken place. From March, 1888, to January, 1889, her attacks increased in frequency, from one in two weeks to two and sometimes three a week. On considering the long interval of consciousness after an attack was felt to be coming on before the stage of rigidity and unconsciousness occurred, the doctor thought that the case might be one of focal epilepsy. He finally took her to an oculist for an examination into the condition of her eyes, but nothing abnormal was detected

[1] Medical Mirror, London, 1870, Vol. VII, p. 128.
[2] Annales de Gynecologie et d'Obstetrique, Paris, 1881, Tom. XV, p. 401.
[3] Medical and Surgical Reporter, Philadelphia, 1879, Vol. XLI, p. 206.
[4] St. Louis Clinical Record, 1878, Vol. V, p. 28.
[5] Detroit Lancet, 1879-80, n. s., Vol. III, p. 153.
[6] St. Louis Medical and Surgical Journal, 1884, Vol. XLVI, p. 14.
[7] Deutsche Medicinische Wochenschrift, 1885, No. 4, S. 50.
[8] Berliner Klinische Wochenschrift, 1889, No. 43, S. 934.
[9] *Ibid.*, 1890, No. 13.
[10] Proceedings of the Kovno Medical Society, 1889, p. 36.
[11] Journal of American Medical Association, 1890, Vol. XIV, p. 111.
[12] Medical Record, 1888, Vol. XXXIV, p. 65.
[13] American Journal of the Medical Sciences, 1889, n. s., Vol. XCVII, p. 587.

in the examination. The doctor then took her to his own residence, and as the attacks nearly always occurred at night, after one nap, he had her sleep in an adjoining room. About five minutes before the attack she would call him, and having time to dress himself partly, he would go almost immediately to her. At no time during nearly two months and a dozen seizures could he discover any rigidity of any muscles or set of muscles, fingers or toes, in advance of the general muscular convulsion. He, therefore, gave up the supposition that it was a case of Jacksonian epilepsy. The case was, therefore, unquestionably one of typical epilepsy, and it was attended by nearly all the customary phenomena. There were convulsive movements of all the muscles, frothing at the mouth, biting of the tongue, and a period of unconsciousness, followed by a condition of languor.

A complete history of the patient was gone into by the doctor. He found that she had experienced two falls, one from a horse and one from a step-ladder. He could not learn, however, that there was any interval of unconsciousness after either, nor could he discover any mark or asymmetry of the cranium, nor that she had any disease or lesions about her, with one exception—she had suffered from nasal catarrh for quite a long time, and there was obstruction to nasal respiration. For the purpose of investigating the latter condition, the doctor brought her to me for an examination. There was found considerable inferior turbinated hypertrophy on both sides, and in the right nostril there was an exostosis of the middle turbinated bone which pressed firmly against the septum. Pressure against this region with the probe produced the sensations which she experienced just previous to the occurrence of an epileptic convulsion. The nasal obstructions were, therefore, removed, together with the exostosis in the middle turbinated bone.

For some time previous to the date when I saw her she had become very restless, and had much mental depression, particularly for a time after each attack. This condition speedily disappeared after the removal of the intranasal abnormality, and she has had no attack of epilepsy since. That this improvement is due solely to the operation in the nose, both Dr. Townsend and myself unqualifiedly believe, for the reason, as he states, that the patient had not taken for months before the operation, nor has she taken since, any medical or other treatment, except an antiseptic solution that I gave her to be used in an atomizer for spraying and cleaning the nose for a time after the operation.

Case 2.—Master A. B., aged 14, was referred to me September 16, 1891, on account of a persistent headache, associated with more or less nasal obstruction, attended with frequent convulsive attacks, the nature of which had not been definitely determined. About a year and a half before I saw him he began to have very severe headaches, confined mainly to the frontal region. This was increased by study in school, by exposure to the sun, or any excessive heat. The first convulsive attack occurred one year before I saw him. He became much heated after riding a bicycle, became dizzy, and had a short convulsive attack, falling to the ground from his wheel. This was followed by a dull pain and a very uncomfortable sensation, confined to the frontal and nasal region. This pain was much aggravated by stooping. After this first attack they were repeated at frequent intervals, but were usually excited by active exercise, exposure, or any condition that would naturally excite nasal turgescence. The parents became alarmed about the condition of the lad, but no direct connection had been thought by them to exist between the nasal condition and the convulsive attacks, nor by the family physician, who referred the boy to me for treatment of the nasal obstruction. On examination the left middle turbinated bone was found to be very markedly hypertrophied, projecting in the form of a sharp bony ridge against the septum. On the right side the turbinated body was very much hypertrophied, being pressed firmly against the septum. The whole interior of the nose was very vascular, much congested, and very sensitive to slight irritants, although the patient had not suffered from hay fever. The treatment required was clearly indicated; the removal of this intranasal pressure in both the nasal passages—the hypertrophied tissue in one and the hypertrophied middle turbinate bone in the other. After the removal of this pressure not only did the headaches cease, but there were no further indications of any epileptic seizures, and the lad has remained entirely free from them since, now nearly two years having elapsed. He has regained the brightness that he partially lost, and at the present time enjoys a condition of perfect health.

The richness of the nasal region in sensitive nerves makes it possible for us to understand how it is that the nose is one of the organs that most frequently causes neuroses of reflex origin. By no means, however, let us on this account attribute all neuroses to intra-nasal disease, for it is a fact which should never be overlooked that identical nasal lesions can produce with different persons different neuroses.

In one instance we may have epilepsy, in another vertigo, in another chorea, in another supra-orbital neuralgia, megrim, or persistent headache, and in another asthma, while in other cases there may be no reflex at all. As I have elsewhere stated,[1] the explanation seems to be that the nervous force is like an electric current and travels in the line of least resistance. In one case the line of least resistance may be in one direction and in another case in another direction, and thus the manifestations vary according to the anatomical or physiological conformation or variation in different subjects.

As to the influence of the condition of the nervous system in cases of epilepsy, it can not be denied that the ganglionic centers of persons having a susceptible nervous organization are more readily affected by local or reflected irritation than those having a less susceptible organization; but it is by no means true that such natural susceptibility is necessary in order that the neurosis may be excited by the peripheral irritant. A long-continued nasal disease may, and in the majority of cases does, lower the tone of the nervous system and the inhibitory power is thereby lessened. Thus with the continuance of the affection a neurosis is developed that is as much secondary to the primary disease in the nose as the nervous disturbance resulting from an abscess in the ear is secondary to a diseased tooth that may have been the direct cause of the abscess by the irritation of the otic ganglion.

In one of the cases reported by Crossfield, referred to above, the patient's habits were faultless, but he was very much emaciated, with a sallow complexion and a hacking cough, associated with night sweats. His appetite was varying, but generally poor. In the second case the young man was well nourished and full-blooded, rather large for his age, 17. In the second case reported by Schneider, the young woman, aged 24, was strong and well built, and engaged in active outdoor life, being a haymaker. In the fifth case the man was strongly built, but suffered from a number of nervous troubles. Fincke says that the man treated by him was strong and active. The girl cured by Abramson from nightly epileptic attacks, resulting from hypertrophic rhinitis and enlargement of the turbinated bodies, was the daughter of a hysterical mother. The two cases that have come under my observation were by no means of a neurotic habit. As might be inferred then, a severe attack of epilepsy often results from a disproportionately small irritant, owing to the condition of the central nervous system having been previously lowered. With reference to the supposition that natural susceptibility is necessary for a peripheral irritant to produce a marked neuroses, it may be interesting to note that in about one-half the cases of epilepsy cited above as being the result of intra-nasal disease the reporters have mentioned the fact that their patients were naturally well nourished, strong, and active. The portions of the nose of which a diseased condition seems most liable to occasion epileptic attacks are the septum and the middle and lower turbinated bodies. The etiological factors most frequently met with are turbinated hypertrophy, exostosis, and polyps. In the case reported by Fincke, nasal polyps were found in the right fossa. Of the cases reported by Schneider, in two there were polypoid growths, with exostosis of the septum; in two other cases the lower turbinated bodies were hypertrophied, and in the remaining two cases the affection is described merely by the indefinite term "swellings on both sides."

Chronic hypertrophic rhinitis, with enlargement of the left two lower and right middle turbinated bodies, occasioned the epilepsy in the case recorded by Abramson. In the first case reported by Crossfield there was found on the right side marked hypertrophy of the inferior turbinated body, causing almost complete

[1] New York Medical Journal, Vol. XLVI, p. 257.

stenosis. On the left side there was marked deviation and exostosis of the septum, while the inferior turbinated body was hypertrophied. In case No. 2 there was absolute nasal stenosis, both the right and left inferior turbinated bodies being hypertrophied. In both of the cases that I have reported the convulsive disturbance was due to the pressure from turbinated exostosis and enlarged turbinated bodies against the septum.

From a careful study of all the cases of reflex disturbance from nasal disease coming under my observation, I have come to regard the septum as the center from which these disturbances most often radiate, and not the sensitive areas in the turbinated bodies, as has hitherto been regarded.

Starr[1] has recently stated that in all cases where local irritation is sufficient to cause epilepsy the patient will have his attention sufficiently directed to this localized disorder to cause the local disturbance to be discovered. In this respect I do not agree with him. Many cases of neurotic disturbance have come under my observation where it was only by the merest chance that the local cause was discovered. Hence we can not emphasize too highly the importance of examining the nose in all cases where the cause of epileptic attacks is at all obscure. That epilepsy has other causes than nasal irritation goes without saying, but that nasal disease is a factor of prime importance in its production has also been fully proven.

SOME FORMS OF NASAL REFLEXES, WITH REPORTS OF CASES.

By Dr. S. K. MERRICK,

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While a few are still skeptical as to the connection between the treatment of intranasal diseases and the cure of certain so-called "reflexes," located in some more or less remote portion of the body, I take it that the great body of medical men, especially among throat specialists, believe the connection to be close. To mention the names of all who have contributed to our fund of knowledge would lead us far beyond the limits of this paper, but it may not be amiss to refer to a few whose labors have thrown special light upon this interesting subject.

Voltilini[2] seems to have been the first writer to bring the question of the nasal reflex to the attention of the profession when he reported a case of spasmodic asthma, due to a nasal polypus, cured by removal of the growth. This observation has since been verified by others.

Seiler,[3] Hack,[4] and John N. Mackenzie[5] subsequently published cases of reflex cough, due to morbid conditions within the nasal cavities. Hack[6] in his monograph reports a large number of reflexes, among them are gastralgia, dyspepsia, cardiac palpitation, tumefaction and redness of the skin of the nose, salivation, neuralgia of the first two branches of the trigeminus, cephalalgia, migraine, ciliary neuralgia, scotoma, photophobia, vertigo, exophthalmic goitre, and others. Elsberg,[7] Salinger,[8] and Bosworth[9] have reported cases of chorea, due to hypertrophic rhinitis. Cases of epilepsy, due to intra-nasal disease, have been reported

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[1] Medical Record, New York, 1890, Vol. XXXVII, p. 1.
[2] "Die Anwendung der Galvano-Kaustik." Vienna, 1872.
[3] Arch. of Laryngology, Vol. III, No. 3, p. 240.
[4] Berlin. Klinische Wochenschrift, 1882, No. 25.
[5] Amer. Journal of Medical Sciences, July, 1883.
[6] Wein. Med. Wochenschrift, 1882-'83.
[7] Trans. Amer. Loryngological Asso., 1883.
[8] Polyclinic, Phil., June, 1887.
[9] Deformities of the nasal septum, N. Y. Med. Record, January, 1887.

by Salinger,[1] Fincke,[2] and Bosworth,[3] while T. A. McBride[4] reports a case of psychical epilepsy. Ziem[5] reports a case of nocturnal enuresis, while North[6] thinks most cases of neurasthemia will be found to have intra-nasal disease. Two cases of salivation of reflex origin are reported by Bosworth[7] and one by E. Frankel, and cited by Rualt[8] and Bosworth, were cured by treatment of intra-nasal conditions, upon which they were dependent. The question of ocular disturbances of nasal origin was forcibly brought to the attention of the profession by Dr. Gruenning,[9] of New York, in a paper read before the Academy of Medicine, in January, 1886. Beverly Robinson,[10] Cheatham,[11] and Bettman[12] report cases of many forms of eye troubles dependent upon intra-nasal conditions. Many names might be added of those who have reported nasal reflexes affecting divers organs, but the foregoing, in view of their eminence and respectability, are quite sufficient to emphasize the fact that nasal reflexes are not uncommon, nor confined to a very limited portion of the economy.

The moral effect has been invoked to explain the action of treatment in effecting cures. I, however, agree with Bosworth that, while "it may have some force," it is purely secondary and adventitious in the great majority of cases, but in a small per cent of them I am constrained to believe it is the chief if not the only factor in achieving the result. Bosworth believes that the successful results are due primarily and mainly to the removal of local intra-nasal disease. In this view I can not fully concur. While this is so in most cases, there remains a small number which are relieved before the morbid condition in the nose is cured, and must be explained on the theory of counter-irritation, which was sufficient to excite healthy action in the nerve centers, presiding over the site of morbid action, before it effected a cure at the site of application.

There are three prominent or chief views held as to just how these reflexes are cured, viz: (1) By moral influence; (2) by counter-irritation, and (3) by removal or cure of the morbid causative condition within the nose. That no one of these theories will adequately explain the *modus operandi* of the curative agent in all cases, I firmly believe; and that all three of them may be necessary to do so, the following cases will, I think, prove:

Case 1.—G. S.; male; aged 28; native of Baltimore, Md.; merchant; parents living and well; one brother died of pulmonary tuberculosis, and a sister is suffering with a chronic cough. Patient consulted me November 5, 1892, complaining of intense headache and vertigo, which had persisted, in spite of all remedies, for the past six months, until life had become a burden and he feared sometimes he would "lose his mind" if he did not get relief. As his nose had become more or less obstructed and a sense of pressure over bridge of same was nearly always present, he had concluded that nasal catarrah might have something to do with his distressing headaches and vertigo, and had accordingly come to consult me. An examination revealed in both nasal fossæ, highly inflamed and senitive turbinates, which were the seat of both false and true hypertrophy. At the second visit, November 7, the inferior turbinate on one side was cauterized, and on the 9th he told me his headache and vertigo were much improved. On the 14th the cautery was again used on the other inferior turbinate, and at his next visit, on the 18th, he told me he was entirely relieved and delighted beyond measure with my treat-

[1] *Loc. cit.*
[2] Moniteur de la Polyclinique, June 7, 1885.
[3] *Loc. cit.*
[4] N. Y. Record, Vol. XXIX, p. 137.
[5] Monatsschift für Ohrenhielkunde, Nos. 8 and 9, 1886.
[6] Med. Register, Philadelphia, May 14, 1887.
[7] Dis. of the Nose and Throat, Vol. I, p. 190.
[8] *Loc. cit.*
[9] N. Y. Med. Record, January 30, 1886.
[10] Med. Record, April 3, 1886.
[11] American Practitioner and News, Louisville, April 2, 1887.
[12] Journal of the American Medical Assoc., May 7, 1887.

ment. Beyond a slight shrinking of the inferior turbinates I could see little improvement in the intranasal conditions. The marked relief which my patient had experienced seemed out of all proportion to the slight changes effected within the nose. This, together with the fact that a severe rhinitis was still going on, forced me to the conclusion that the nerve centers, responsible for the head symptoms, had been stimulated into healthy activity by the first cauterization, and that the marked improvement which took place within two days could not be due to improvement in the intranasal morbid condition, which was not sufficient to be noticed on the closest inspection at that date. This patient did not return for further treatment after his head troubles, vertigo and headache, were relieved, although his rhinitis was still uncured.

Case 2.—A. E. M., male, aged 30, native of Pennsylvania, station agent Pennsylvania Railroad (family history not known), consulted me June 15, 1888. The right nasal fossa was nearly normally patulous, there being slight hypertrophy of inferior turbinate and chronic rhinitis. The left fossa, however, was nearly completely obstructed by a deflected septum and an exostosis which rose up from the inner side of the floor of the nose, half inch from its anterior opening, the two deformities leaving a small triangular opening for respiration. Both fossæ were in a high state of inflammation, and after about two weeks of soothing treatment I operated on the deflection and a week later upon the exostosis. The catarrhal process began to improve rapidly after free respiration and drainage were established. A few days before I was ready to discharge him, he told me one morning with evident delight that the cocaine which I had been using in his nose had restored his eyesight. This was the first intimation I had had that he had defective vision, although I had observed that he wore glasses. He had discarded them the night before, finding he could see better without them. I found upon inquiry his was a case of asthenopia of several years' standing. I of course explained to him that the real cause of the restoration of normal and painless vision was the removal of nasal obstruction and cure of his catarrh, and that the cocaine played no part in it, except as a local anæsthetic during the operation.

Case 3.—Miss L. C. B., single, aged 27, born in Montgomery County, Md., weight 145 pounds, above the medium height. Parents living and healthy; six sisters and three brothers, all strong and healthy. She was referred to me by Dr. William P. Chunn, of Baltimore, Md., who thought she had some nose and throat trouble which needed attention. March 1, 1893, I made an examination of patient's nose and found a badly deflected septum of traumatic origin, dating from a fall on the ice, in girlhood, while skating. The knuckle of deflected cartilage was transverse and firmly adherent to the inferior turbinate of the left side, involving the sutural junction between the bony and cartilaginous septum. The middle turbinate was much hypertrophied and pressing down on the knuckle of deflected cartilage, but not adherent to it. The left nasal fossa was, by these deformities, almost completely closed. The inferior meatus of the right fossa was completely filled with an hypertrophied inferior turbinate, which on close examination was found tightly bound down to the floor of nose by adhesions, the result of an operation done by a physician in a neighboring Virginia town, just before she had the grip. Both nasal fossæ were operated on—one with scissors and cautery and the other by means of the saw and cautery, and free respiration and drainage were established. Owing to hæmorrhage from the sawing I found it necessary to plug and replug daily for three days the fossa with cotton wool, and an interesting and instructive feature of the case hangs upon this circumstance, which will be referred to presently.

Twenty-four hours after the cotton tampon was dispensed with my patient returned to my office, telling me I had cured her of a most serious and distressing eye trouble of long standing. I then elicited the following history of her case, as nearly as possible in her own words. Eight years since, she began to have headache and the first disturbance of vision. It became impossible to place a book at the proper distance for reading. When she thought it was right it would immediately get wrong. This difficulty increased, and seeing double and often triple, with blurring, jumbling, and half blotting out of words, constantly harassed her efforts at reading. By the end of six months she could not see well enough to paste pictures in a blank book for a child, and had to desist on account of imperfect and painful vision. She then consulted a prominent oculist of Washington, D. C., who gave her three pairs of glasses, which she wore as directed. These made her condition more tolerable and improved the painful vision, until two years since when she had the grip, followed by measles, when it became necessary to again consult an oculist, who was also a distinguished specialist of Washington, D. C. After some treatment of the eyes, the right eye was operated on for slight external strabismus. Vision after this was easier, somewhat, but reading and

writing were impossible, and vision at all times remained painful, and dread of light was always present. She was to return after a month or two and have the other eye operated on for a similar condition, but fell into my hands before the time arrived for her next visit. I was entirely ignorant of the foregoing history of her eye trouble until she related it to me, four days after I had operated upon her nose.

As long as the cotton tampon remained in the nasal fossa after the operation no improvement in her vision took place, but six hours after it was removed she suddenly discovered that she could read by gaslight with perfect comfort, and at once seated herself and wrote a letter to her mother, without glasses, telling her of the "glad news." She had been unable to write for several years. It was the following morning she informed me of the result of the operation upon her eyes. She remained under my care for about two weeks, during which time her vision remained easy and good, and I have a letter dated July 29, 1893 (about four months after the operation), in which she tells me she has just paid a visit to Dr. M., of Washington, D. C., and he frankly admits that my treatment of nose has rendered it unnecessary to operate for strabismus on the other eye, and that there is not the least doubt about the benefit which resulted from the operation.

Case 4.—J. S., male, aged 45, married, engineer, enjoyed good health until six weeks previous, when he was compelled to stop work on account of great pain in right thigh and hip. Patient consulted me October 12, 1887; at that time he was walking with a cane and limping badly. It transpired that he had been relating his case to a neighboring barber, who was under the impression that nearly all ailments were caused by catarrh, and insisted that my patient should consult a throat specialist at once. I learned the names of two reputable physicians who had been treating patient since his trouble began, but no relief was realized. The man had become convinced that all his trouble in leg was dependent upon "nasal catarrh," and that when the latter was cured he would get well of the former. I frankly told him that there was no connection between the two affections. I found on examination a mild chronic rhinitis, most marked in left inferior turbinate, which I told patient I would operate on, and did with the galvanic cautery. Two days later patient returned, walking without a cane and with a very slight limp, saying he began to get better on leaving my office at his previous visit. At his next visit he declared himself well, and has remained so to this date. No one can convince him that he was not cured by the electro-cautery. I saw little or no change in the intranasal condition, and it is possible that it had no connection with the sciatica, with which the man was suffering on his first visit, but that the case was one similar to that of Bouchard, referred to by Bosworth in his book, volume 1, page 197, where a case of sciatica was cured by cauterizing the lobe of the ear. The description which he gave to the barber of the operation, and of his feelings during the progress of the same, lead me to the conclusion that the "moral influence" was the chief if not the only factor in effecting the cure.

This case, however, is reported to invite the opinions of others and some rational explanation of the connection which exists in such cases between the cauterization and the morbid action so remotely situated, and not with the view of expressing any very definite opinion of my own. The following deductions, I think, may be fairly drawn from the foregoing cases, viz: (1) That distressing headaches and vertigoes, apparently dependent on chronic rhinitis, may yield to intra-nasal cauterization before the catarrhal process is appreciably improved. (2) That the most serious ocular disturbances may be due to intra-nasal disease, and that presure irritation may be the chief factor in such conditions, and that removal of same may yield the most brilliant results. (3) That pathological processes or symptoms, remotely situated, are, occasionally, unexpectedly relieved by cauterizing the turbinates.

In the preparation of this paper I have freely consulted Bosworth (Diseases of Nose and Throat).

DISCUSSION.

Dr. PRICE-BROWN, Toronto. I can not say that in my experience I have seen any cases of epilepsy that I could trace to neurosis of the nasal cavities, although I have certainly seen some exceptionally nervous patients with neurotic symptoms of that nature that might possibly develop into an epileptic form. A case of that character came under my observation recently. It was that of a lady, about 50 years of age, who had been troubled with sore eyes for several years. There was a good deal of discharge and a constant running of tears over the face, so that she had, on a number of occasions, gone to an ophthalmologist, who had passed an instrument down the nasal duct in order to free the passage to the nasal cavity. Although this was done repeatedly, she still had the same trouble of tears running over her cheeks, and finally she came to me. I examined the nasal passages, the left one in particular, and found there was a large hypertrophy of the middle turbinate of the left side pressing against the septum. This hypertrophy, from which a discharge of pus took place, was very painful. I operated upon it with the galvano-cautery, and removing the hypertrophied tissue I discovered that the middle turbinated bone itself was pressing into the septum. I sawed a portion of it off, with the result that there has been a complete cessation of the eye symptoms. There is no more running of tears over the face, there is no tendency to conjunctivitis, and the associated ophthalmological neuralgia has passed away. Of course, the discharge of pus from the antrum still continues. It may be possible that the pus, not escaping sufficiently, might give rise to the other symptoms; but as the occlusion was only on one side, while both were affected, it seems to me to be largely a reflex condition.

Another case was that of a young lady who had hay fever for fourteen years; she is 25 years old now and she has had the disease since she was 12. Hay fever in her case had the peculiarity of commencing in June and ending about the 1st of August. On examination I found the columnar cartilage completely filling in the right nasal cavity, pressing against the septum; of course she could not breathe on that side. I cut through the mucous membrane and with saw and scissors cut out one-half of the columnar septum and by means of a tampon kept the nares open. The result was that all the symptoms of hay fever which she had when she came to me passed away and she has had none since. I think the symptoms of hay fever in her case arose principally from the pressure of the columnar cartilage against the ala of the nose.

Dr. S. SOLIS-COHEN, Philadelphia, Pa. I have been much pleased with the moderate tone of the paper read and the judicial nature of the conclusions arrived at. I suppose some members of the section at least are familiar with the position I have taken, opposing the extravagant assertions made by men of insufficient experience in describing a large variety of diseases as solely due to morbid conditions of the nasal chambers, it having been my fortune to meet with many cases of such conditions in conjunction with diseases of the nasal chambers, in which I purposely refrained from local treatment in order to test the dependence of so-called reflex symptoms upon the nose or upon constitutional conditions. The cases stated by Dr. Roe are, however, beyond criticism. The epilepsy in these cases, so far as I am able to judge, must have been due to the conditions of the nose which he relieved. I have no criticisms to make of Dr. Merrick's cases. Scattered throughout the literature here and there are such undoubted cases, and there must be others unpublished. I am inclined to believe, however, that many of the cases reported of reflex disturbances due to nasal conditions are not dependable. Some of the cases appear to have been insufficiently studied, in others the conclusions are not justified by the reported facts, and in some instances with

which I am personally acquainted the reporters have not had sufficient acquaintance with general medicine to be able to exclude the general causes. In this connection I would like to differ somewhat with Dr. Roe as to the necessity of the neurotic substratum for these manifestations. I believe such neurotic disposition to be essential. It may not, however, give rise to marked phenomena in the absence of peripheral irritation in the nose or elsewhere. I have recently investigated a number of cases presenting certain neurotic phenomena in the domain of the vaso-motor system. In some instances there is apparently a very slight departure from normality. It would not attract attention unless sought for, yet when the cases come to be studied and investigated from all standpoints the evidences of instability in the circulatory mechanism will be found. I should not be at all surprised if in many cases of reflex disturbances from nasal irritation the patients would, upon investigation, be shown, as some of my hay-fever patients have, to have this neurotic instability of circulation, which would account, when mechanical causes are insufficient, for the vertigo and for the disturbance of vision. In some of my cases ocular disturbances have been quite prominent, and even epileptic attacks are among the phenomena associated with this condition. I find the same thing existing in several members of a family, and in some instances there has been marked heredity. I would ask Dr. Roe and the members of the section, in future cases of apparent nasal reflex neurosis, to investigate especially two features of the case. First, whether cardiac action can be disturbed by slight causes, causes that in a thoroughly normal individual would not be adequate to effect such disturbances; and, second, whether the phenomenon called dermographism can be produced. The test is made by writing with a probe upon the skin of the patient at any point, say on the inner surface of the forearm, the skin having been made tense by clinching the fingers. Light pressure is used. In a very few moments the device traced will stand out in bright red characters, and in some patients in a few minutes large welts will appear resembling the welts of urticaria; in others deeper pressure is required to produce this factitious urticaria, and in some who are still less susceptible the additional application of cold. I do not know that these conditions are present in nasal reflex, because, unfortunately, in the 50 cases I have studied there was none in which I was able to discover any condition in the nasal chambers which I would consider adequate as a source of peripheral irritation. The cases reported by Dr. Merrick of ocular disease are certainly interesting; and conversely to them are the cases stated by Gould, in which correction of ocular defects cured nasal catarrh and hay fever. The question of moral effect, raised by Dr. Merrick, is most surely one which can not be excluded in considering some of these cases. In Dr. Roe's cases of epilepsy there was hardly room to suspect merely moral effect. In the cases of sciatica reported by Dr. Merrick, and in some others, moral effect must, however, play a large part. I remember having reported to the American Laryngological Association some years ago a case of obstinate sneezing in a patient who insisted upon having her nose cauterized in order to cure it. I did not cauterize it, but she did not get well until I said I would apply an electric current. I applied a constant galvanic current, and thinking it was the cauterization which she had insisted upon having applied, the patient promptly recovered. That surely points to more than a suspicion of moral effect. In conclusion, I would allude to a class of cases, one of which has but recently been under my care, in which with marked intra-nasal exostosis there coëxists headache associated with a sense of pressure at the root of the nose, and with sensitiveness to pressure over the intra-orbital and supra-orbital foramina. In about half a dozen such instances I have seen the headache, which occurred periodically, disappear upon treatment with quinine hydrobromate, administered four to six hours before the attack in order to have its maximum effect at the time of the expected paroxysm. This drug is

usually administered in conjunction with ergot in order to prevent any bad effect of the quinine upon the ear. The combination of quinine hydrobromate and ergot having relieved these headaches while I have left the nasal deformity untouched, and on the other hand, as in a case specially reported, skillful treatment of nasal conditions at other hands than mine having failed to give relief to headaches that afterwards yielded to medication, I am constrained to minimize the nasal factor in many cases. I believe there must be quite a large number of such cases. Others probably see many more of them than I do, because, being in general practice, the number of nasal cases I see is not so great as that seen by other members of this section.

Dr. A. W. DE ROALDES, New Orleans. I fully agree with Dr. Cohen and Dr. Merrick when they call attention to the fact that persons affected with reflex troubles from intranasal disease are not always to be looked upon as belonging to the constitutionally neuropathic class of patients. In order to emphasize this point allow me to refer to a case which came under my observation a few weeks ago. The subject was a country girl of about sixteen years of age, who was brought to my office for some aural trouble on one side. She was a fine specimen of country life, in exceedingly good health, of strong nerves; could ride a horse, fire a gun, and feared nothing. Menstruation was normal. The drum on the affected side was opaque and somewhat retracted, the hearing having diminished considerably on that side in the last eighteen months. Mouth breathing was observed, due to intranasal obstruction, the result of an osteo-enchondromatous deviation of the septum on side of the affected ear. I suggested an operation to relieve at once the nasal trouble, which would allow me afterwards to treat the ear. Cocaine was applied, and the obstruction mostly sawed off, when all at once, as the instrument reached the upper and posterior part of the bony ridge, the girl complained of a severe pain in the head, especially in the supraorbital region, with a marked disturbance of respiration. The pulse rose to about 118, she was pale and fainting; whisky had to be administered and the operation hurriedly finished. At the time I attributed these symptoms to the effect of cocaine, for I had used it in a rather strong solution. All at once the patient began to cough and she coughed for two hours, one of those harrowing, incessant, short, expiratory coughs. Everything was tried to relieve this painful symptom. Primary anæsthesia with chloroform, pushed even to the point where the eyeballs were made insensible to the touch, would but partially relieve the cough. I had finally to resort to a hypodermic injection of one-third of a grain of morphine, which allowed her removal to her home. That condition kept up for three days, when to procure rest the family physician had to resort several times to the use of morphine hypodermically. After three days the cough had mostly disappeared and the condition much improved, when she reported to the office in my absence. My attendant, Dr. Scheppegrell, had scarcely inspected the intra-nasal wound and resorted to a very gentle mopping when the girl began to again complain of pain in one side of the head, with irritation behind the ear and in the neck, and the same violent cough returned. This time electricity was resorted to, with temporary relief. The cough nevertheless returned after she had reached home, lasted a whole week, giving the young woman only three or four hours of sleep, depressing her, and interfering seriously with nutrition. A third attempt to clean out the nasal passage, on the eleventh day, brought about the same state of affairs, lasting about twenty-four hours. After such an experience the parts were left undisturbed and the intra-nasal wound left to heal up naturally; henceforth the girl's condition improved, and she has never had a recurrence of the cough, which, as a result of the operation, had for fourteen days rendered her life miserable. The second and third attempts at treatment were made for the sake of clearing a possible doubt without the use of cocaine. This is as marked an example as I have seen of a nervous trouble, set up evidently

as a reflex by the traumatic effect of the operation, in a strong and healthy young woman, devoid of any neuropathic taint. In such cases the reflex troubles are, I think, better explained by some direct nervous communication, especially when developed in the area of innervation of the exciting intra-nasal disease, or in its immediate vicinity, where nervous anastomoses or continuity of tissue can be invoked. Suggestion will be of no avail in the relief of such cases. On the other hand, I am inclined to accept its good effects in cases of neurasthenic patients, in whom the reflex troubles are developed at a distance.

Dr. F. C. Cobb, Boston. I would like to ask how long relief lasted in these cases, the epileptic ones especially? I have found in cases of vasomotor rhinitis that when the obstruction was removed the asthmatic symptoms were very much relieved for a time, but in a year they almost always returned, yet the nose remained almost clear. It seems to me that time is a great factor in deciding how much is suggestion and how much cure.

Dr. S. K. Merrick, Baltimore. I should like to ask Dr. Cohen in the cases he referred to with vertigo and headache where there was pressure over the bridge of the nose similar to one of the cases I reported, what doses of hydrobromate of quinine he gave, and whether or not the cure in these cases was permanent.

Dr. Cohen. The dose varied from 10 to 30 grains, the 30 grains being given in two doses. The cure in two cases was permanent; in one case the gentleman came under treatment but a short time ago and I am unable to say what the result will be; the other case I have been unable to hear from since.

Dr. Merrick. In the case I reported there was a great deal of sensitiveness and both false and true hypertrophy were present. It seems to me that anything that will control the circulation or get possession of the nervous system is desirable. I think quinine exercises a great deal of influence in hay fever, and that condition is simulated in many of these cases such as I related. Ergot also controls the circulation, but it simply emphasizes the fact that if the circulation is controlled and the pressure relieved that it will not militate against the idea or assumption that the case was originally one of reflex origin, reflected from that point of irritation; simply controlling the circulation by hydrobromate of quinine does not show that it was not originally caused by pressure irritation within the nose. One point I would like to answer that refers more especially to Dr. Roe's paper; that is in regard to time. I stated that in one of my cases the man had remained well since 1887, and he is still well. One of the eye cases I followed for six or seven months, the case that believed himself cured by the use of cocaine. In the last case of ocular disturbance it has been about four months, and the patient is now using her eyes as well as ever.

Dr. John O. Roe, Rochester, N. Y. In regard to the points raised by Dr. Cohen as to the uncertainty of this condition being due to local irritation as a primary factor, or to a constitutional condition, I think it would be difficult to establish that fact, as we have no means of estimating exactly how much general disturbance the local irritation has caused. We can not say that the general disturbance has not been the result of the local irritation or that the general constitutional impairment of the system has not caused the present susceptibility to this local irritation. We know that if we have so simple a disturbance as a toothache for a short time we become very much depressed, our inhibitory powers are lessened, and the circulatory system much disturbed. So any local irritation in any portion of the body may manifest itself in a general neurotic condition or a disturbed condition of the circulatory system. In a great many of these cases we find a primary weakened condition, causing a proclivity for these disturbances which a local irritation readily develops, but we can not say positively that in a great many cases the local irritation has had a great deal to do with bringing about a condition that may be the exciting cause of epilepsy. In regard to the general

treatment of these cases, in which we have a central disturbance induced by a local cause, it may be said that the administration of drugs, such as those that will quiet the nervous excitability or will so deaden the afferent nerves that the local irritation ceases to be communicated to the brain centers, will have the same effect as if we remove the exciting cause. Consequently, the medication has but the effect of stopping the paroxysm for a certain length of time, or during the continuance of the effect of the drug. It is, however, of the utmost importance to resort to restorative and supporting measures, for in all of these cases, whether due to a primary central disturbance or a local cause, there is always a lowering of the tone of the general system, in very much the same way as a short-circuited electric wire will prove a marked drain upon the main electric current. In regard to the length of time these patients were under observation, in case 1, four years have elapsed since the patient was under treatment and she remains at the present time perfectly well. In case 2, two years have elapsed since treatment was discontinued, and the patient is in perfect health.

IMPORTANCIA DEL ESTUDIO MICROSCÓPICO DE LAS MUCOSIDADES LARINGEAS, PARA DESCUBRIR OPORTUNAMENTE LA INFECCIÓN TUBERCULOSA LARINGEA É INSTITUIR UN TRATAMIENTO CONVENIENTE.

Por el Dr. ANGEL GAVIÑO,

Profesor adjunto de Higiene, Profesor de Bacteriología de la Escuela de Medicina de México, Médico del Consultorio Central de Beneficencia y Secretario de la Academia de Medicina de México.

SEÑORES: Todos vosotros que habeis observado la laringe en numerosos casos, podreis haber comprobado el hecho de que en general la mucosa laringea no presenta caracteres especiales en el principio de la tuberculosis de este órgano. Cierto es que la hinchazón y la palidez de los cartílagos aritenoides y de la epiglotis en la tisis laringea son un buen signo de presunción, sobre todo cuando existen en el enfermo otros del lado de las mucosas ó de los pulmones; que los antecedentes de la familia, que la proximidad de personas tuberculosas, y otros elementos, pueden hacer suponer que haya una tuberculosis laringea si el funcionamiento del órgano se modifica y los síntomas de inflamación crónica se acentúan. También puede ser casi indudable el diagnóstico cuando se han demostrado degeneraciones necrósicas tuberculosas, ulceraciones clásicas, en las encías ó en la faringe. Estas degeneraciones, estas ulceraciones de pequeñas dimensiones y muy numerosas, con tendencia á la reunión y á extenderse en superficie más bien que en profundidad, son ya un signo demasiado elocuente para que el clínico ponga en duda la infección tuberculosa de la laringe; sin embargo, algunos prácticos muy notables han incurrido en error cuando se han fijado solo en el aspecto de las pequeñas ulceraciones y en otros de los signos reputados como casi inequívocos, ejemplo de ello es Heinze, quien habiendo observado en 1876 á 50 enfermos en el Hospital Jacob, los cuales fueron elegidos entre los que presentaban todos los caracteres de la tuberculosis pulmonar, declaró ser las ulceraciones laringeas tuberculosas, convenciéndose después de que de estas ulceraciones solo el 83 por ciento lo eran y el 17 por ciento no lo eran. Esto significa que aún en el período de ulceración ó cuando este se inicia, es algo inseguro el diagnóstico y que en estos casos como en aquellos de presunción, y aún en los que se reputan como simples laringitis catarrales crónicas, es necesario otro elemento que como el microscopio ayude á aclarar cuanto ántes la naturaleza de la afección.

Pues bien, en varios enfermos que se me han presentado pidiendo tratamiento de su laringitis crónica, y en los que solo existía enrojecimiento é hinchazón de

la mucosa con lijero enronquecimiento de la voz, he hecho el exámen microscópico de las mucosidades adherentes tomadas con un pincel fino en los repliegues de la mucosa, ya en la base de la epiglotis, en su cara laringea ó en los antros de Morgagni, y he encontrado en algunos el bacilo de la tuberculosis, siendo así que por el exámen laringoscópico no estaba autorizado á dar un diagnóstico seguro y no podía inclinarme á la existencia de una laringitis tuberculosa.

El conocimiento de la naturaleza de una afección cuando aún no se encuentran comprometidos órganos importantes ó que la infección no se ha generalizado, es de todo punto necesario si se quiere obtener un resultado con los elementos médico-quirúrgicos de que actualmente disponemos. Esta idea muy general ha sido reforzada en su importancia con el importante estudio previo de las mucosidades faringeas de los supuestos difteríticos, pues ha venido á enseñarnos que cuando el clínico aún no puede pronunciarse por el diagnóstico de la difteria, ya el microscopio y las culturas en suero, denuncian la presencia del bacilus de Löffler, y proporcionan al práctico un conocimiento de colosal importancia que le permite combatir la afección en su principio, y por consiguiente multiplicar las probabilidades de éxito.

Si en la difteria se alcanzan hoy brillantes resultados, como pasa en el Hôpital des Enfants Malades de Paris en el servicio del Dr. Simon, ¿porque no aplicar el mismo medio en todos los casos en que una laringitis comienza á hacerse duradera y refractaria á los medios terapéuticos comunes en las afecciones catarrales?

Siempre recuerdo, para enseñanza, de lo que reputo como necesario del exámen microscópico en todos los casos ligeramente sospechosos, á dos enfermos, uno hombre, el otro mujer, quienes durante algún tiempo fueron tratados como afectados de un catarro crónico simple laringeo, por presentar un lijero edema glótico con enrojecimiento de la mucosa y una ronquera y afonia incompleta intermitentes y que al cabo de nueve años han caido en mis manos, y he podido demostrar en el hombre una necrosis tuberculosa de los cartílagos aritenoides y de la epiglotis y la destrucción del ligamento ventricular izquierdo y de la cuerda vocal izquierda, y en la mujer un inflamamiento considerable al nivel de los aritenoides, más el del lado derecho, y una ulceración irregular y granulosa en el repliegue inter-aritenoideo derecho. En ambos casos la demostración del bacilus tuberculoso no dejó lugar á duda respecto al diagnóstico. No es indudable que si en estos casos ó en otros semejantes, se demuestra con tiempo la naturaleza específica de las lesiones, se podrán evitar, retardar, ó disminuir los terribles destrozos que pueden sobrevenir posteriormente,

En los enfermos en los que bien temprano he podido demostrar la presencia del bacilus de Koch he instituido el siguiente tratamiento que me ha dado muy buenos resultados:

(1) Inyecciones intra-laringeas, tres veces por semana de la siguiente solución:

	Gramos.
Aceite de almendras dulces	100
Creosota de haya	3
Salol	3
Salicilato de bismuto	2

S. Inyección intra-laringea.

(2) Aplicaciones con el pincel en los repliegues de la mucosa laringea de una solución de cloruro de zinc y sublimado:

	Gramos.
Cloruro de zinc	5.00
Sublimado	0.05
Agua destilada	90.00
Glicerina	10.00

S. Toques para la laringe.

(3) Tres píldoras diarias de la siguiente fórmula:

	Gramos.
Creosota de haya	1.00
Guayacol	1.00
Extracto de opio	0.15

P. Píldoras No. 50.

Tanto las inyecciones de un gramo, como los toques laringeos, los enfermos los toleran muy bien, y he podido continuarles el uso cuotidiano de las píldoras de creosota durante muchos meses sin el menor inconveniente.

Periódicamente he estudiado las mucosidades laringeas al microscopio y he podido notar la diminución progresiva de los bacilus. En tres enfermos han desaparecido casi completamente se puede decir, pues con trabajo se encuentra uno que otro en la preparación, y los síntomas se han mejorado en dos de ellos al grado de no presentar molestia y de haberse reducido la hinchazón laringea sin que aparezca el aspecto pálido opaco de una mucosa tuberculosa.

Creo por tanto necesario el que en ningún caso, por poco sospechoso que sea, se deje de recurrir á este medio diagnóstico que oportunamente permitirá al especialista instituir un método curativo tal vez eficaz.

THE TREATMENT OF CERTAIN CASES OF CHRONIC CATARRH.

By Dr. ANGEL GAVIÑO, City of Mexico.

[Abstract given by Dr. A. W. de Roaldes.]

Dr. Gaviño wishes to call attention to some cases of apparently chronic catarrhal affection of the larynx; those cases which after having been treated prove rebellious to the treatment. He calls attention to the fact that, in his opinion, from his experience, in some of these cases it is advisable to examine the laryngeal secretions microscopically; that is, in those cases where nothing objectively in the larynx or chest would permit one to suspect any tubercular affection. In such cases he has had the laryngeal secretions examined and has even gone so far as to scrape the mucous membrane; but only in cases where there is no infiltration or ulceration that might lead to the suspicion of tuberculosis, and in such cases he has found in the secretions or the scrapings, Koch's bacillus. This has been a sufficient reason to him to carry on that practice systematically and he has been able in that way to diagnose laryngeal tubercular trouble and to institute the proper treatment in time and long before the objective symptoms, either of the chest or the larynx, would have led him to believe that he had to deal with tubercular trouble. Accordingly, he suggests the advisability in those cases of making a microscopic examination of the secretions and even scrapings of the mucous membrane of certain parts—the arytenoid cartilages, false folds, ventricular bands, and epiglottis. The treatment he suggests is laryngeal injections of an oily substance containing creosote, salol, and salicylate of bismuth, local application of bichloride of mercury and chloride of zinc, and creosote given internally. His conclusion is that even in apparently healthy mucous membrane, where nothing attracts the attention but the rebellious condition of the part to treatment, microscopical examination of the secretions and scrapings of the mucous membrane will often reveal the bacillus tuberculosis when we least expect it, and we are in that way able to institute early germicidal treatment, especially creosote.

DISCUSSION.

Dr. D. BRYSON DELAVAN, New York City. This is certainly a most interesting paper. The plan proposed is a decidedly new departure, different, so far as I am aware, from any we have heard of before. There are without doubt instances in which tubercular disease seems to develop primarily in the larynx, more probably than we are aware of, because of the difficulty of the diagnosis. If this means could be carried out, with reasonable skill on the part of the practitioner, it would seem, as the writer of the paper has indicated, that in a certain number of cases at least an early diagnosis might be reached. I hope that the paper may be translated and we may have the pleasure of reading it in English, as it seems to me to embody a very valuable suggestion.

ALUMNOL, ITS EXCELLENT PROPERTIES FOR USE IN THROAT AND NOSE PRACTICE; A NEW ANTISEPTIC AND ASTRINGENT.

By J. MOUNT BLEYER, M. D., of New York City,
Visiting Laryngologist to the West Side German Clinic, etc.

Following upon the discovery of kairin, the first of the series of synthetical substitutes for chinin, and that invaluable one, antipyrin, together with naphthol, resorcin, urethan, methylene blue, benzoinol, and others of the same group introduced to us by those excellent chemists, Meister, Lucius & Bruning, of Hoechst, Germany, comes another of their preparations for which, after careful trial and investigation, I predict a long career of usefulness. I refer to alumnol, which only recently was isolated and prepared by Drs. Heinz and Liebrecht also, those chemists who first demonstrated the possibility of building up alkaloids in the laboratory, and were the ones who gave to us the new synthetical medicaments now passed beyond the stage of experiment, whose value as combatants of disease can not be underrated. Kairin, for a long time after its discovery, was regarded as one of the many curiosities that are born in the chemical laboratory, only to remain as such; and so, too, was the early fate of its successor, antipyrin, which, as we all know, has since become one of the most valuable therapeutical agents in our pharmacopœia. It is only since the days of Dalton, Gay-Lussac, Dulong and Petit, Mitscherlich, Berzelius, Avogado, Faraday, Whöler, and others that the chemist sees in the past course and present tendency of organic chemistry the strongest proofs of the influence and value of the doctrine of Dalton and of these other scientists. Within the past few years many of the new synthetical[1] remedies have found their way into our materia medica, and a knowledge of their nature, history, and properties is essential to every progressive medical man whose aim it is to keep abreast of the rapidly developing pharmacology of the age. My object is, before entering upon the discourse regarding alumnol, etc., which is also one of these synthetical compounds, to trace historically part of the development of synthetical chemistry, in order to make it clear to those not so thoroughly versed in this branch of science.

As far back as 1823 Gay-Lussac and Liebig clearly recognized the existence of isomerism.[2] It is in the domain of organic chemistry that isomerism finds its numerous and most striking examples. Isomerism, after its recognition, showed the fact that the same elements may combine together in the same proportions and yet give rise to totally distinct compounds, and also that fact that it must

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[1] Synthesis—meaning in chemistry the uniting of elements into a compound.

[2] In chemistry this term means: Identity or close similarity of composition and molecular weight with difference of physical or of both physical and chemical properties.

ultimately depend on difference in the mode in which the atoms of the constituent elements are combined. The discovery of the identity in qualitative and quantitative composition of silver fulminate and silver cyanate by these chemists was in reality one of the most momentous discoveries of the century. These were followed quickly by new discoveries in that direction by other chemists. As these many facts were born and made known to the science of chemistry they profoundly influenced chemical thought by demonstrating that the attributes of bodies depend not merely on the nature and number of their components, but also on the mode in which these components are arranged and distributed. Chemists for the first time clearly recognized that their business was not only to determine the quality and quantity of the various atoms in a compound, but also the manner in which those atoms were grouped and held together. This, indeed, is the great problem of modern chemistry, and each successive theory of the last half century may be valued in proportion as it has ministered to this end. The idea of atomic grouping lay at the basis of the doctrine of radicals, by means of which the chemists of sixty years ago sought to make evident that organic compounds are fundamentally similar to organic substances. It lay, too, at the basis of the unitary views, which, with the discovery of the principle of substitution by Dumas, began to gain ground in organic chemistry. The fact of substitution, indeed, is as inexplicable as the law of multiple proportions, except upon the atomic hypothesis. The nucleus theory of Laurent and the different type theories of the French school, and of their successors in England, all tacitly recognized the existence of atoms.

The limits of this paper preclude the possibility of the attempt to show how these various theories have given place to more rational modes of viewing the structure of organic compounds. Unquestionably the two most powerful factors in determining the present character of organic chemistry have been: firstly, the recognition by Frankland, 1852, of the fact that the atom of every element is inherently endowed with a specific combining power, varying within certain limits, whereby it is able to unite with a definite number of atoms of other elements; and secondly, the hypothesis of Hekule and Couper, which graft themselves directly on Frankland's discovery, concerning certain peculiarities in the mode of combination of the element carbon, the organic element par excellence. Although nothing is known as to the real cause of valency, that is to say, of the cause which enables the atoms of carbon to take to itself and hold in stable union four atoms of hydrogen or of chlorine, and no more than four, and which forbids the atom of hydrogen or of chlorine to do the same thing as regards carbon, it will be obvious that the fundamental idea of valency is essentially atomic in conception. From this time the attempts of chemists to unravel the internal structure or constitution, to use the term first introduced by Butlerow, of organic compounds, took a new departure. Great numbers of compounds hitherto unknown and undreamt of were prepared because theory indicated their existence. The mode of genesis and the nature of the transformations of these bodies threw fresh light on the manner of the grouping of the atoms in bodies already known; and the knowledge thus gained enabled chemists to conceive the methods by which such bodies might be synthetically prepared. Indeed, it may be safely asserted that whenever the constitution of an organic substance is clearly made out the synthetical formation of that body comes within the sphere of practical chemistry. It may not be uninteresting in this connection to take a short survey of the progress which has been made in synthetical chemistry during the last fifty or sixty years. Such a survey, however rapid, will take us into every department of the organic world. During the past half century the chemist has succeeded in forming the active principles or characteristic products of many plants; he builds up substances which have hitherto been regarded as made only by the very process of

living of an animal; and he has formed substances which were thought to be produced only by changes in organized matter after death.

That particular day in 1828 when Wöhler first observed the transformation of ammonium cyanate into urea should be accounted a red-letter day in the history of science. This discovery virtually gave the death blow to the notion that the operations which are concerned in the formation of the chemical products of the organic world are fundamentally different from those which take place in the inorganic world. Urea, or the final product of a series of tissue changes, is preeminently a typical product of animal life; no more characteristic example of a substance formed by the action of the so-called vital force could possibly be adduced. By demonstrating that urea can be made synthetically by ordinary laboratory processes and from substances inorganic in their origin, Wöhler proved that vital force is only another name for chemical action, and that an animal is nothing but a laboratory in which a multitude of chemical changes, similar to those which occur in our test-tubes and controlled by essentially the same conditions, is continually taking place. Since the date of Wöhler's discovery, urea has been synthetically prepared by many reactions. Thus it was obtained by Natanson and Basarow by the action of ammonia on carbonyl chloride. This and the other reactions have a special interest from the circumstance that all the substances taking part in them can be formed directly or indirectly from their ultimate elements. Associated with urea as a product of the oxidation of the nitrogenous compounds in the organism are uric acid, xanthin, and sorcin. These bodies are met with in greater or less quantity in urine and in certain forms of urinary calculi, and they are invariably present in the blood and muscle juice. In chemical composition they differ from each other simply in the amount of oxygen they contain. Urea was first artificially transformed into uric acid by Horbaczewski. Its synthesis has also been effected by Behrend and Roosen. Closely related in chemical composition to these bodies are theobromine and caffeine, the active principles respectively of cocoa, coffee, and tea. The widespread use of caffeine-containing products is undoubtedly of great physiological import, and its interest is enhanced by the intimate relationship which is now shown to exist between caffeine and the products derived from the oxidation of nitrogenous matters within the organism. Xanthin, indeed, has been recently transformed into theobromine by Emil Fischer.

Of late years much attention has been paid to the study of the putrefaction of albuminous substances of animal origin with the result that a considerable number of basic nitrogenous bodies, some of which are highly poisonous, have been isolated. These compounds were classed by the Italian toxicologist Selmi under the generic name of ptomaïnes. They are the products of the vitality of the micro-organisms which are concerned in setting up the putrefactive change. Their discovery has greatly modified our views as to the mode of action of pathogenic organisms, and it is now regarded as not improbable that the disturbances are due rather to the presence of these poisonous compounds. It ought to be stated, however, that the attempts hitherto made to isolate the toxic substances which may be formed by the growth of pathogenic organisms have been attended with only partial success. Thus Nencki was unable to detect any toxic substance among the products of anthrax and staphylococcus aureus, a common organism in abscesses which yields only a nonpoisonous base. On the other hand Briegger, to whom we owe the detection of a large number of these so-called cadaveric alkaloids, has found that the typhoid bacillus yields a poisonous substance which he has named typhotoxine; and he has also discovered that the bacillus of tetanus forms a base now called tetanine, which gives rise to symptoms which have a strong resemblance to those occasioned by the inoculation of the bacilli.

All the ptomaines hitherto isolated are comparatively simple in composition and not very complex in chemical constitution. Some of them have been shown to be identical with bodies already known. Thus choline, a nonpoisonous alkaloid found in bile by Strecker, in the brain and in the yolk of egg, and now known to be the product of the putrefaction of meat or fish, has been synthesized by Wurtz; whilst neurine, a derivative of brain substance, originally confounded with choline, but differing from it in composition and in possessing intense poisonous properties, has been artificially produced by Baeyer and Hofmann. Choline and neurine are closely related substances, and can be readily transformed into each other. Another of the so-called corpse alkaloids, cadaverine, has also been synthetically formed by Ladenburg.

In 1870 Schmiedeberg and Koppe isolated the poisonous principle of the fungus Agaricus Muscarius, which they named muscarine. Subsequently muscarine was obtained synthetically. It is, however, among the products of plant life that some of the most valuable syntheses of modern times have been effected. Tartaric acid, the characteristic acid of unripe grapes, and citric acid, the acid which gives sourness to limes, lemons, and oranges, have each been artificially prepared.

Many attempts have been made at various times to effect the artificial formation of vegetable-alkaloids, such as quinine, morphine, strychnine, etc., but as yet with only partial success. There is little doubt, however, that such synthesis will be accomplished when the constitution of these complex substances is better understood. Up to the present time only two alkaloids have been synthesized, one completely, viz, conine, and atropine. A considerable number of the odoriferous principles of plants have been obtained artificially, such, for example, as bitter-almond oil and oil of mustard. Salicylic acid, vanillin, and alizarin are now also synthesized. The remarkable industrial results which followed Graebe's and Liebermann's discovery from coal-tar derivatives, which completely destroyed a staple trade of France, Holland, Italy, and Turkey, naturally roused chemists to attempt the artificial formation of a dyestuff not less important, viz, indigo. This has been accomplished, independently, by Baeyer, by Heumann, and by Heymann. No synthesis of recent years has created a keener or more widespread interest than that of the sugars, dextrose and lævulose, which has been recently effected by Emil Fisher. It is interesting not merely as an instance of the artificial production of well-known substances, but also on account of the light it is calculated to throw upon the origin and mode of formation of the sugars in the vegetable kingdom. This has been accomplished through the medium of glycerin. The advance in every section of chemistry during the latter half of it has literally been by leaps and bounds. Although practically a creation of our own time, no branch has been more fruitful in result, in suggestion, or in possibility than that of organic synthesis. The mere gain in the knowledge of fact is immeasurable; it is even more impossible to gauge the profound effect of that knowledge on other departments of human effort and intellectual activity. Past history shows only too well that there is a tide in the affairs of science, as in all other things, that constitute affairs of men. There are periods of ebb and flow, of advance and retrogression. But of this we are certain: in chemistry the flood has only just set in, and it is still very far from high-water mark.

Alumnol is a remedy to which I desire to call the attention of my colleagues, the laryngologists, on account particularly of its antiseptic, astringent, and highly non-poisonous properties, which, by the way, are its marked characteristics, and which alone must give it prominence as one of the most useful agents in our branch of practice. In looking up the pharmacological literature in relation to the subject, I find that many different preparations of aluminium have been used as antiseptics, particularly the acetate and aceto-tartrate, both of which are freely soluble in water and possess the advantage over the others of being devoid of poison-

ous effects. But, like all our therapeutical investigations, we continually are brought to realize that even among good remedies some are decidedly better than others. It is like the Irishman's whisky. And so it was with solutions of aluminium salts; while good in many ways, their demerits far outweighed their merits. In the first place, the stability of the solution could not be relied upon, and that, in conjunction with other chemical disadvantages, such as throwing down a precipitate of an insoluble base, proved to us that they were not safe agents to employ in daily practice where an unshaken confidence in the evenness of a preparation is absolutely essential. These are among the more important reasons that are given us for introducing an aluminium preparation, perfectly stable when in solution and capable of retaining an evenness of strength, yet possessed of all the advantageous principles which we look for in aluminium. Such a preparation, I unhesitatingly say, we find in alumnol.

Chemically speaking, alumnol is the aluminium salt of a napthol-sulphionic acid, containing 15 per cent of sulphur in the form of the sulphon group and about 5 per cent of aluminium. It assumes the form of a fine-grained white powder, which may readily be dissolved in cold water to a strength of 40 per cent, this enabling us to make any strength of solution without the danger of separation of the salt from its solvent. It is also soluble in glycerin and hot alcohol. In the latter solvent it exhibits a beautiful blue fluorescence. It is insoluble in ether. Heinz and Liebrecht, its discoverers, tell us that it possesses reducing properties, which they say is evident from its behavior with nitrate of silver, especially when warmed. As a result of this fact alumnol undergoes a change by long exposure to the air, becoming darker. This change, however, does not affect any of its properties and stabilities. Like all the solutions of aluminium salts it has an acid reaction. These salts will precipitate albumin, but differ in this respect from other astringents in that the precipitate immediately redissolves in an excess of albumin. This very behavior of alumnol makes it doubly valuable, enabling it to mix with the fluids of the body rich in albumin and thus enter into the tissue substance. Alumnol will be found to be a most powerful astringent. This property I have tested in many ways, viz: If applied to the tongue in solutions of 0.01 per cent in strength patients have readily become aware of the astringency of the the remedy. Much milder solutions, such as 0.0025 to 0.005 in strength, give me like results. I made several experiments on the vascular membranes of animals, and in each case the peculiar astringent property of the alumnol became evident. It was an astringency unlike that of the astringents commonly used by us. In solutions up to 5 per cent in strength there was not the slightest sign of irritation to the membranes experimented upon. Let this suffice for a brief description of the more important chemical features of alumnol; and now a word about its therapy as I know it.

In speaking clinically of alumnol I shall give, in brief, cases in which I found it possessed of advantages above those of other astringents I have used. One of the first cases in which I had an opportunity to use alumnol was a case of epistaxis. Here the epistaxis was due to an erosion of the membrane covering an arterial twig in the cartilaginous septum, and in one or two other varieties much like that form which we so often find associated with cirrhosis of the liver in its early stage, where rupture of the capillaries of the nasal fossæ occur. Here the application to the membrane of a solution of 0.25 to 1 per cent in strength controlled the hæmorrhage in short order. A tamponade saturated with a solution of the same strength is equally efficient, and I have not the slightest doubt that insufflations of powder in the same proportion may be used. I also treated several cases of simple and chronic rhinitis of the form that comes under the observation of the rhinologist almost daily in the following manner, with exceptionally good results: First, I carefully cleansed the passages with a warm solution of

sodium bicarbonate, 1 dram to 1 pint of water. This was followed by the injection of one-fourth per cent solution of alumnol. The cases all showed signs of improvement after a few applications. I also tried the efficiency of alumnol in cases where I had operated for nasal polypi. For several days after the removal of the growths I used an alkaline wash, alternating with injections of a one-half per cent solution of alumnol. In two out of four cases thus treated no recurrence of the trouble followed. The other cases passed from my notice, and hence I am not able to acquaint you with them. In two cases of ozena, one of syphilitic and the other of constitutional origin, both were treated with alumnol with most gratifying results. The nostrils were ordered washed twice or thrice daily with a copious application of sodium bicarbonate, one-half teaspoonful to the ounce of warm water, which was followed by a one-half per cent solution of alumnol. After the last daily washing, a powder containing one-half per cent of alumnol was insufflated. Where abrasions of the mucous membrane were discovered they were covered over with lanolin, containing 5 per cent of alumnol. Often when the incrustations were extensive I applied a cotton wool tamponade, moistened with a very weak solution of alumnol, which I left in the situ from two to three hours, leaving the patient to remove them according to instructions. In these cases the discharges became less offensive, and if we can have such good results I can not praise alumnol too highly. In two cases, when I curetted to remove post-nasal adenoids, I used a mild solution of alumnol, from 1 to 2 per cent, both as a disinfectant and astringent. In one case where the hæmorrhage was excessive the flow was immediately controlled by a 1 per cent solution of alumnol. Not long ago I had occasion to see several cases of syphilis. One was of the bullous variety, with laryngeal complication. The ulceration implicated a large area of both the pharynx and the larynx. In these cases I used douches of alumnol, 1 per cent, after cleansing the parts with an alkaline solution. The antiseptic and healing properties of the alumnol were marked by the fact that the ulcerations healed up in from eight to ten days. In tonsilitis, where the glands are inflamed symmetrically, and which varies much in severity and should not be confounded with suppurative quinsy due to septic causes, often attacking several members of one family, and frequently concomitant with scarlatina and diphtheria. In short-lived outbreaks of so-called infectious sore throat, occurring from bad sanitary surroundings, etc., I have secured very good results from gargles and irrigation with a 2 per cent solution of alumnol.

Alumnol is undoubtedly a nonpoisonous antiseptic and astringent, acting not only superficially but also upon the deeper tissues, owing to its ready diffusibility. The tonsils, we know, are absorbant glands, and their function not improbably may be connected with the absorption of certain elements of these poisonous bacteria which enter the system through this channel. The great advantage of alumnol in this instance seemed to be its power to disinfect the channels without occluding them. This is mainly due to the extreme readiness with which alumnol disfuses itself. I was not long ago told that one bacteriologist who used it found it to be a bactericide of high grade. In most cases of acute and chronic laryngitis, where we are prone to lay much stress on the application of astringent solutions, alumnol in 1 per cent solution gave a good account of itself, especially in those instances where there was a congestion of the vocal bands, the arytenoid cartilages, or interarytenoid folds. I can not conclude this paper without saying a few words about the action of alumnol upon mucous plaques of the tongue of specific origin, in the treatment of which we have not had much to encourage us until lately. I need not dwell upon the many local applications that we have been in the habit of using from time immemorial, but I will say that none gave me such results as alumnol or chromic acid. By vigorously pushing the alumnol application I soon found that it suited patients far better than chromic acid.

In conclusion let me say that in alumnol I find a remedy which is soluble in water, has a penetrating action which makes it specially active, not only against recent inflammatory affections, but against those chronic forms in which infiltrations and induration have occurred. For the latter a higher concentration of the remedy is necessary (from 5 to 10 per cent). Another great advantage is that it can be worked up into various forms, as with glycerin, lanolin, vaseline, gelatin, etc. My short experience with alumnol has been very gratifying. I must ask you to try its efficacy, which I know will not disappoint you.

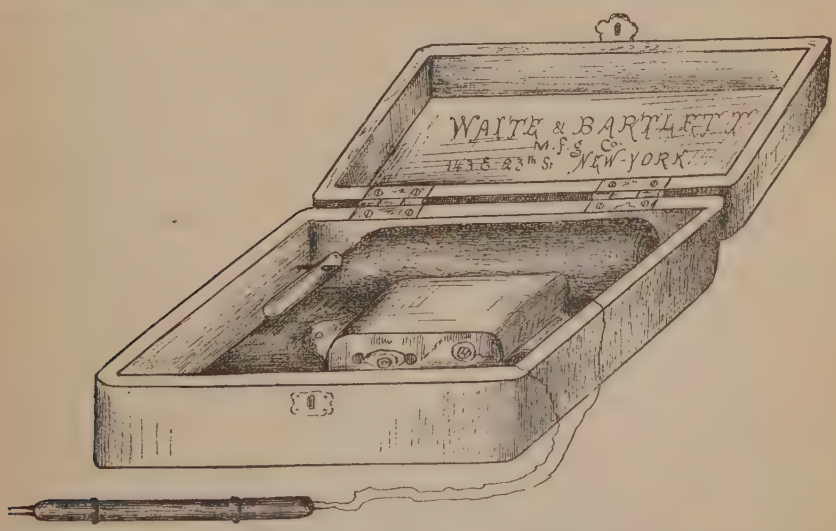
DISCUSSION.

Dr. D. BRYSON DELAVAN, New York City. I have been using alumnol for six months and find it a remarkably good astringent, although I have not proved in my own practice all that has been said of it.

EXHIBITION OF INSTRUMENT FOR FINDING LOST INTUBATION TUBE.

By Dr. J. MOUNT BLEYER, of New York City.

This is my first model of an instrument, which I please to call an electrical probe searcher, for the discovery of a lost intubation tube within the lower air passages. The usefulness of this instrument was practically demonstrated several



months ago upon such a case. This accident has befallen me only once in over 540 of my cases which I had operated on from the year 1886 to 1892. Nevertheless such another may happen again to me and others who operate. The diagnosis of a lost tube can be made by means of this searcher without delay and anxiety, which I believe is worth the price of its cost.

The apparatus consists, as you see, principally of three parts: (1) The battery; (2) the alarm; (3) the bipolar needle-pointed searcher; contained, with their accessories, in a box 4½ inches by 3 inches, and is complete in itself, requiring no external supplies. The battery is made up of a carbon cell, with zinc electrode,

and is charged with bisulphide of mercury, made ready in a moment's notice by adding a teaspoonful of water to one-fourth teaspoonful of the mercury powder. The alarm is a buzzer. The searcher is a bipolar electrode, with two fine-pointed needles of 1 inch long.

The method in using the instrument is very simple, the probe or searcher being handled in the same manner as a pen. It is held in the right hand, and with the left the skin over the trachea, or in the suspected location of the tube is made tense by an assistant. The needles are thrust in between the rings of the cartilages of the trachea, and explored until the contact is made between the searcher and the tube. Both points of this needle probe usually touch the metal tube at once, and a bridge of contact is formed, which obtains a signal from the buzzer. The location of such a tube is determined beyond a doubt, and preparation for its removal is next in order. This method of searching does not hurt the child.

A CASE OF ELONGATION OF THE EPIGLOTTIS REDUCED BY OPERATIVE MEASURES.

By PRICE BROWN, M. D., of Toronto, Canada.

In the treatment of the case I now report I am much indebted to Dr. Rice, of New York, for a paper read by him last year at the annual meeting of the American Laryngological Association, entitled "The troublesome symptoms caused by the enlargement of the epiglottis, and the advisability of reducing the size of the cartilage by operative measures." I was much impressed by the article when I read it, as I had on several occasions treated patients for laryngeal disease, in whom the epiglottis presented either an abnormal development or some unusual feature in reference to position. In no case, however, up to the time of writing, have I found it advisable to operate, except in the one which I have the honor to report to you to-day. And in this case, owing to its being more one of malposition than malformation, I was obliged to resort to the method which Dr. Rice, at the time of the preparation of his paper, considered inadvisable, namely, the galvano-cautery.

On February 27, 1893, Miss M., æt., 23 years, tall and slight in figure, presented herself for treatment. Family history was not good. Although both parents were living and healthy, yet on the father's side there was extensive tuberculosis. Two of her brothers likewise had died of consumption, between the ages of 20 and 30 years. The patient herself had been delicate from infancy; and according to the statement of her family physician the apex of her left lung had already, upon two distinct occasions, been diseased. During early childhood her respiration had been of a whistling character; and throughout life she had been subject to throat colds, attended by marked hoarseness, sometimes amounting to complete aphonia, and lasting for a period of one or two weeks. One other interesting feature was the difficulty the patient had always experienced in freeing her throat from mucus. Two years prior to consulting me her physician sent her to Colorado Springs for six months. She returned much improved in general health, but with little amelioration of the throat symptoms. When she came for advice she had been free from cold for several weeks. Laryngoscopic examination revealed a healthy larynx, so far as could be seen. The epiglottis, however, was long and narrow, with the end turned up, and it occupied a completely horizontal position. During ordinary respiration the whole of the free end pressed against the posterior wall of the pharynx; while during forcible inspiration or expiration it was raised slightly, seemingly enough to admit the passage of a narrow knife blade. The whole larynx was deeply seated, and it required 2¼ inches from the right angle of the laryngeal probe to reach the tip of the epiglottis. Fortunately the patient was tractable. The manipulation of the parts was tolerably easy; and, as a good view could be obtained, I considered the case a favorable one for operation.

On March 1, after applying a 15 per cent solution of cocaine, I made the first tentative touch with the galvano-cautery, and for the next two days watched care-

fully for pseudo-membranous inflammation or edema, as the possible results of the operation. The reaction, however, was slight, and on the 4th, during forcible breathing, I slipped the galvano-cautery blade between the epiglottis and the post-pharyngeal wall. Then drawing the former forward by means of the instrument so far as to free the pharyngeal surface, I cauterized the central margin and also the left side of the tip. The operation was followed by sloughing and acute congestion of a mild type, but no edema. I operated upon the remaining portions on the 18th and the 29th. Throughout the treatment, simple albolene sprays were made to the throat several times a day. At no time was the reaction very strong; and owing to the effect of the cocaine the operations were not only painless, but the epiglottis itself remained immobile during the cauterizations, enabling the operator to limit, as he might choose, the amount of work done. During the whole course of treatment the deglutition of fluids was not interfered with to any marked degree. Of course solids were interdicted for several days after each application of the galvano-cautery. The shortening of the epiglottis amounted to about one-quarter of an inch, leaving as a result a permanent niche of about half that width.

On April 1, as the patient was in need of general recuperation, I allowed her to return home to a town 100 miles distant. There was still a protruding corner that I did not like, so I arranged for her to come for further treatment later on. Accordingly, she visited my office again on June 6. The epiglottis during the interval had entirely healed, and although she had suffered once or twice from cold this had not, as formerly, been attended by hoarseness. I found, however, as I expected, a little projecting nodule on the left side. This I touched twice with the galvano-cautery at an interval of three days. The healing was more rapid than formerly, and in ten days the young lady was well enough to return home. On final examination before her departure the sloughs had separated, the epiglottis was uniform in length and regular in outline, and although the organ was still and probably ever would be in the horizontal position, the vocal cords could both be distinctly seen, something that was quite impossible previous to the cautery operations. Six weeks later I heard, directly from my patient's mother, that physically much progress had been made, and that the throat itself was now quite well.

In reference to the advisability of using the galvano-cautery in the treatment of cases of this kind, it must be said that the experience gained by the history of one case is not sufficient to establish a rule. Malposition to the extent and in the form described is probably exceedingly rare. It was fortunate that the epiglottis was both narrow and thin, facilitating operation and reducing to a minimum the probability of edema. If, on the other hand, the organ had been broad or thick or hypertrophic, caustic treatment would certainly have been more dangerous in view of possible pseudo-membranous inflammation or edema of the inner surfaces of the larynx. I have, on several occasions, seen severe temporary edema of the palate and uvula following galvano-cautery operations on the tonsils; and if a like result should occur to the ary-epiglottis folds or ventricular bands from similar treatment of a thickened epiglottis, the end would scarcely justify the means. In well selected cases, however, there are several facts in favor of this method of operating which would seem well worth considering. First of all, sufficient time for thorough and careful treatment is in every way essential for a successful result. Then the operations can be performed bit by bit, and by having the patient under daily observation the parts can be kept under perfect control. There is no bleeding to interfere with examinations, and when cocaine of sufficient strength is applied, we have not only immobility of the epiglottis, but likewise freedom from pain during cauterization. To this might be added that the chiseling may be done so perfectly as to challenge comparison with the normal epiglottis.

For cases in which, for various reasons, the galvano-cautery might be unsuitable, I would suggest the construction of a rectangular epiglottome, in which the teeth would merely transfix the epiglottis, without drawing it further into the ring, as in tonsilotomy. The amount cut off by the blade would thus be under the complete control of the operator. If trimming of the margins was still deemed necessary, this could be accomplished by the galvano-cautery after the healing of the primary wound.

DISCUSSION.

Dr. E. Fletcher Ingals, Chicago. I have had no experience with the galvano-cautery in such operations as this, nor indeed with any instrument, but the thought suggested itself that if the tissue could be removed by a cutting instrument, such as is suggested in the paper, or a punch forceps, the treatment could be carried out much more expeditiously and perhaps with less danger and discomfort to the patient. The galvano-cautery when used by an experienced person like the author of the paper, is perfectly safe and is of great value, but the resulting reaction is always more than if a simple cutting instrument had been employed; therefore the latter would seem better. I do not know that there are any instruments made for the purpose, but it would be easy to devise one of proper angle with a cutting punch or scissor blade.

Dr. Price-Brown, Toronto. I do not think it would be wise to operate in cases of this kind without you can have the patient remain constantly under your care. Then, if the throat was in that condition, you could treat it as you wished. I know there is danger in using cautery instruments of this sort. Some years ago I used the galvano-cautery in removing the tonsils. After operation the patient went out of the city for a week; when she returned she was completely aphonic, respiration strong, temperature 101°. I examined the throat and found inside of the epiglottis a coating of pseudo-membrane, and I thought at the time it was diphtheria, as there were some cases in the neighborhood. The healing of the throat had gone on continuously; there was no pseudo-membrane in the fauces or larynx, only on the inside of the epiglottis. The vocal cords were congested, also the ventricular bands, and there was a certain amount of edema. I treated the case with inhalations of steam and the patient recovered in a few days, but having that case in mind and believing now that it was traumatic instead of diphtheritic, made me particularly cautious as to the manner in which I operated upon the case I have reported. I think you can operate so that there need not be any danger if you have sufficient care of your patient afterwards; but if not, I think it would be dangerous to operate.

THE SIMPLEST AND MOST PRACTICAL ELECTRIC APPARATUS, ESPECIALLY FOR GALVANO-CAUTERY OPERATIONS.

By ARTHUR G. HOBBS, M. D., of Atlanta, Ga.,

Member of the American Medical Association and the Pan-American Medical Congress, Ex-President of the American Rhinological Association, Member of the Georgia State Medical Association, and Fellow of the Atlanta Society of Medicine, etc.

The little apparatus that I am using especially for galvano-cautery operations is the only perfect appliance for that purpose in my knowledge. It has been used in my own and assistants' rooms perhaps a thousand or more times during the last year, and in no instance has it ever failed us or caused us any care or trouble. Indeed, no thought of its presence is ever suggested until it is needed for actual use, quite unlike any of its predecessors, even the best of which required an occasional charging. It is small and compact, contained in a mahogany box 8 inches long, 4 inches thick, and 4 inches deep, and is securely screwed to the wall at a convenient distance from the operator's chair. The wires from an alternating current of 52 volts, the most generally used circuit, particularly in the medium and smaller cities, are brought into the operating room from the street wires and attached at each upper corner of the little box. The conducting wires are similarly attached to the lower corners. The apparatus is now ready to be used for the cautery, the magnet, or for the small incandescent lamp, and it remains always

and ever ready. When the moment for using it arrives it is only necessary, first, to turn a screw, projecting from its nearer surface, with the left hand, while the instrument is held with the right. It thus serves as a gauge for measuring out the exact quantity of electro-motive force in the form of heat, magnet power, or light by modifying the 52 volts, conducted to it from the nearest street transformer, to an alternating current of the fractional number of volts that may be required for the occasion.

As both the force and ampèreage in actual use with this transformer are acquired by induction, and are not in direct contact with the initial current, there can be no possible danger to either the patient or operator, even if the initial wires should by accident come in contact with more powerful wires. The electro-motive force can be gauged between 1 and 16 volts by a screw, and the ampereage is determined by the resistance of the conducting wire. The cost of the electric supply is very small, perhaps $2 or $3 per month for all ordinary purposes, including the rent of the meter.

It is quite easy, by modifying the force with a slight turn of the screw, to adapt it to the forehead lamp in ear operations, and to the still smaller lamp used for translucent and direct illumination in the small cavities, as in antrum diagnoses. A much smaller cautery handle than the conventional one is more convenient for actual use, while in addition to this it may be permanently attached to the conducting cord, where it is always at hand, requiring only to change the point to suit the occasion. The larger handles are necessary, however, for the wire loop operations. The needle and a narrow blade are the only cautery points used in my rooms, and in all cases they are made to enter at the most prominent part of the hypertrophied tissue, penetrate down to the bone with white heat, and then withdrawn through the same puncture while the point is hot. In no case is a wholesale destruction of the mucous membrane ever produced by applying the flat surface of the blade to the protruding part. The needle and the narrow blade produce little or no pain when an application of a 10 or 20 per cent solution of cocaine has been locally applied on a cotton probe ten minutes before the operation. The annoying constitutional symptoms, that not infrequently follow even a weak spray, are rarely encountered when a many times stronger solution is applied to a limited area of mucmous-embrane surface. Its easy control renders it the most reliable and certain means for making cautery operations on the cornea, because of the small amount of electro-motive force required to heat the fine points used for this purpose. This means of treating corneal ulcers, and, I may also add, of reducing the corneal part of a pterigium, is not only less painful than any other, but the resulting cicatrix is more transparent, provided the cautery is not allowed to touch the healthy cornea. A pterigium will in some cases need no further operative procedure, although it will occasionally be necessary, in addition to the cautery, to sever the vascular supply, without excising any part of the hypertrophied conjunctiva except when it is decidedly thickened. The magnet in general use is constructed for the continuous current, yet it can be charged for the lighter uses with the alternating current. My electrician is now adapting one of these magnets to the alternating current for this apparatus. The electric motors heretofore used for fans and drills were supplied with the continuous current only, but some are now being adapted to the alternating current as applied by the transformer. In addition to these varied purposes that this little apparatus may be called upon to serve, the current that supplies it may be still further utilized before its entrance. For example, it will light two incandescent lamps, and at the same time turn two fans or drills where the motors are suitable, and still supply the transformer with sufficient force. While the volume of the current, or ampereage, is large, the electro-motive force can be reduced sufficiently for therapeutic uses where the alternating current is advisable. In short, it is safe; it is inexpensive;

it is always ready; it is reliable; it exacts no time or attention; it dispenses its force and volume in many practical ways; it occupies but little room and is not unsightly; it does its work perfectly, and if it once gains an entrance to the consultation room of one who resorts to electricity in many of its varied forms it will become a fixture.

DISCUSSION ON INJUDICIOUS NASAL OPERATIONS.

In opening the discussion Dr. Hobbs said:

If our friends, the gynecologists, have their nymphomaniacs, I think we, too, may have our rhinomaniacs. We have a class (and it is a rapidly increasing class) of patients who consult us with the avowed purpose, to use their own language, "of having their noses burned out." In some respects these two classes are analogous in that the neurotic factor is often present also in our rhinomaniacs, as it is always present in nymphomaniacs. My point is that we may, without much exaggeration, lay the blame of the injudicious, or at least the unnecessary, operation, when we make it under such circumstances, upon the patient himself, unless we place it upon a higher plane, and refuse in all such cases even the pretense of an operation as a placebo or for its moral effect when its necessity is not indicated. While judicious and properly executed rhinal operations have done and are doing an immense amount of good, for this very reason the temptation is increased in many instances to do operations that were better not done, particularly by the younger men just making their entrée into this special line of work. They are loath to allow an opportunity to pass to saw a septum, to drill an exostosis, or to cauterize a protuberance or an enlarged turbinate. The mere suggestion of a septum spur, or a bony protuberance, or an enlarged turbinate is too often deemed a sufficient reason for a surgical procedure, even though no subjective or other objective symptoms may exist. When we are reminded of the large area of nasal mucous membrane its functions should at once be suggested. The nasal space was intended to breathe through, and only secondarily to serve as an olfactory organ. As this great expansion of mucous surface, twice that of the so-called "throat," is intended to perform the important functions of moistening and warming the inspired air, the necessity of its preservation should never be lost sight of. Hence any nasal operation made without reference to the mucous membrane preservation is not only injudicious but harmful, provided the nature of the case does not necessitate its destruction. And again, where no operation can be made without resulting in a large cicatrix, the question may arise, "Would it not be better left undone?" In cases where chromic acid or any other escharotic would seem to be more appropriate on account of the timidity of the patient, or for any other reason, the toxic sequence should always be considered; otherwise the operation may prove to have been an injudicious one. Septum deflections, spurs, and exostoses should always be carefully measured before any operative procedure is resorted to, else a perforation may result that would be worse than the primary condition. The drill is, in my opinion, almost always an injudicious device, for the reason that it necessarily destroys so much mucous membrane and leaves a rough cicatricial surface, although I find myself resorting to it in some cases of prominent exostoses. To attempt to generalize upon the injudicious external operations that are resorted to most frequently in malignant growths, and occasionally in large benign tumors, would require too much of your time, since each case of so serious a nature is a law unto itself and should always be so treated.

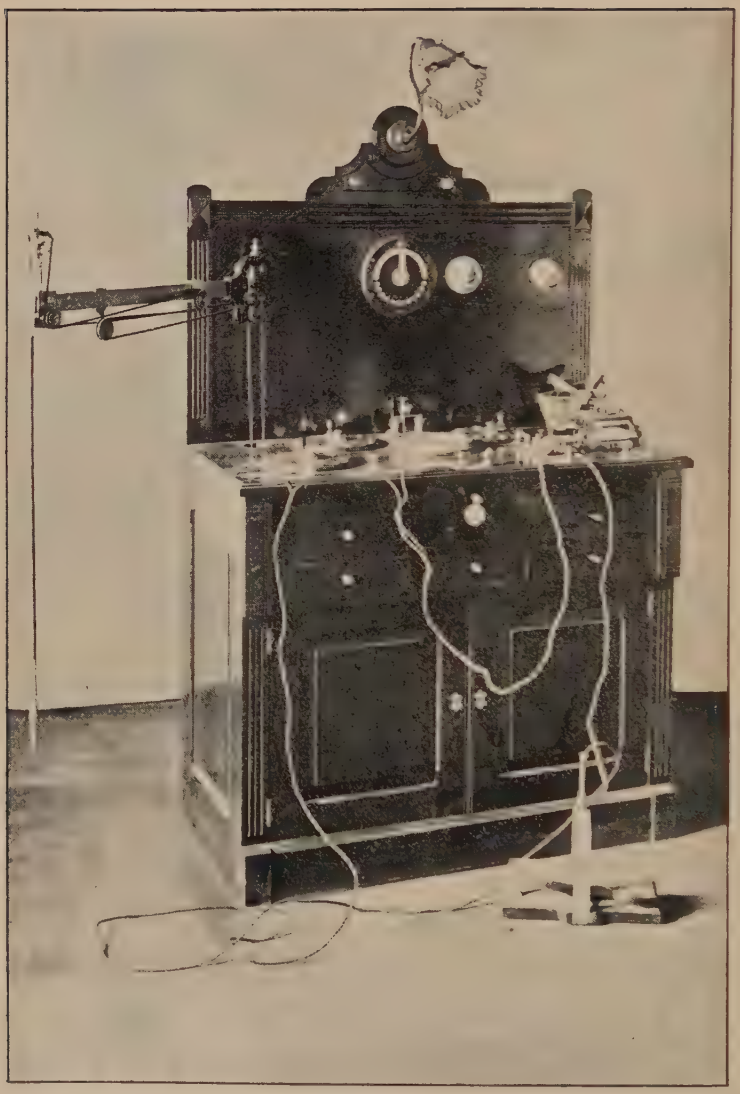


Fig. 1.

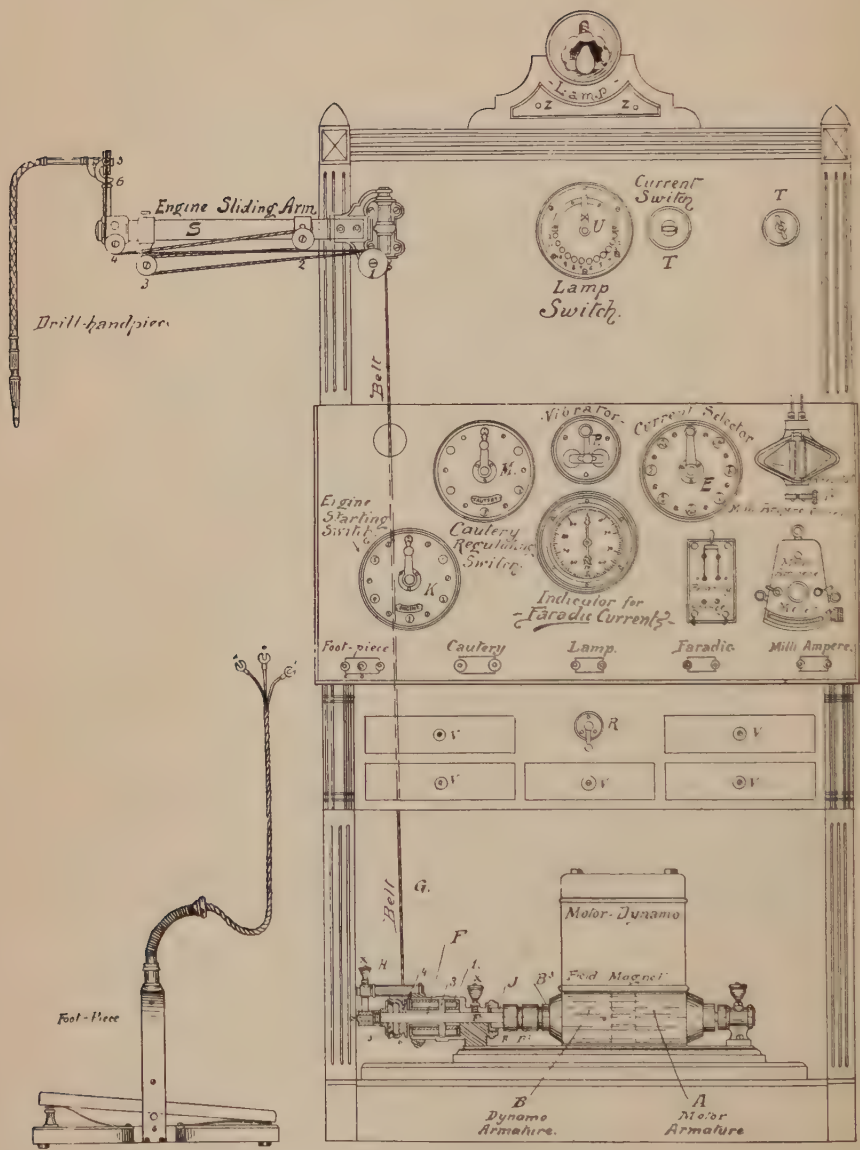

Lamp
Engine Sliding Arm
S
Drill-handpiece
Current Switch
T
Lamp Switch
U
Bell
Vibrator
Current Selector
E
Engine Starting Switch
K
Cautery Regulating Switch
Indicator for Faradic Currents
Foot-piece
Cautery
Lamp
Faradic
Milli Ampere
R
V
Bell
G
F
Motor-Dynamo
Field Magnet
Foot-Piece
B
Dynamo Armature
A
Motor Armature

Fig. 2.

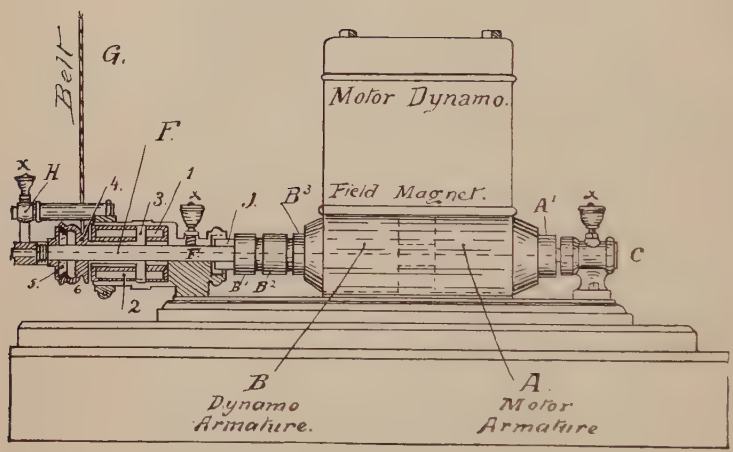

Belt
G.
F.
H
4.
3.
1
J.
B³
Field Magnet.
A¹
C
5.
6
2
B¹ B²
Motor Dynamo.
B
Dynamo
Armature.
A.
Motor
Armature

Fig. 3.

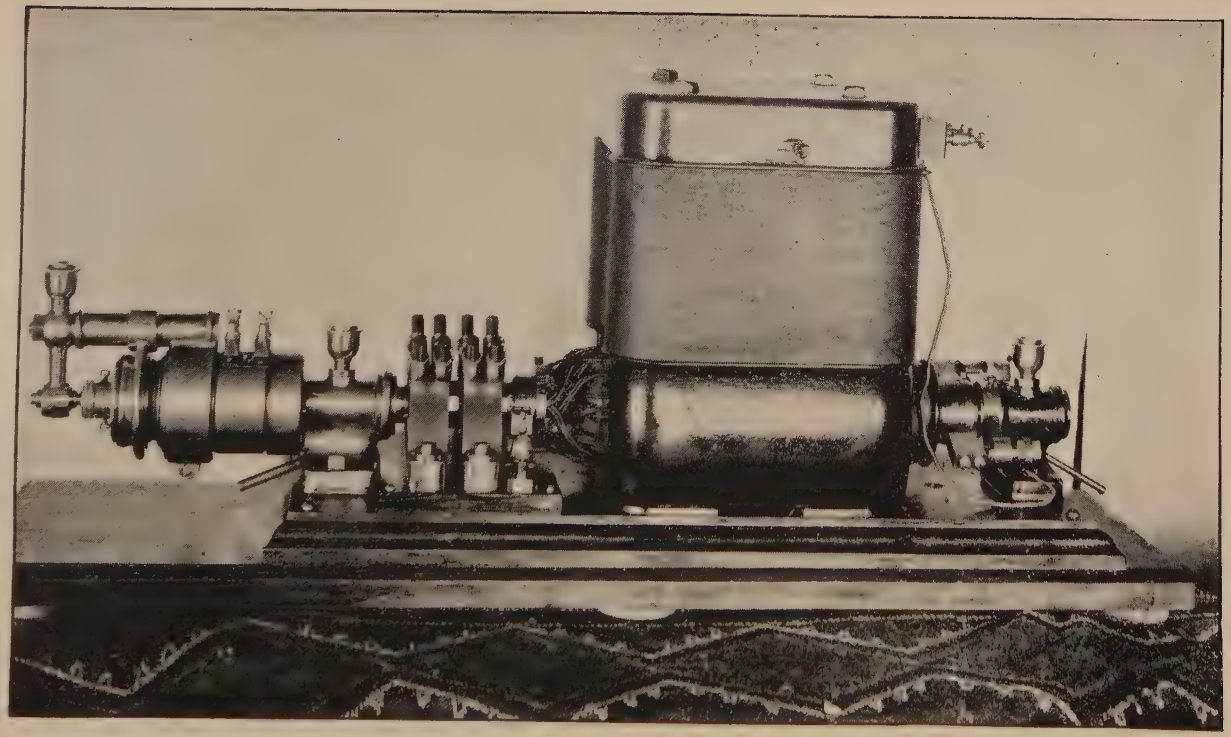


Fig. 4.

AN IMPROVED MOTOR DYNAMO AND ELECTRICAL CABINET FOR THE ADAPTATION OF THE STREET CURRENT TO OFFICE PRACTICE.

By A. W. DE ROALDES, M. D.,

Surgeon in Chief of the Eye, Ear, Nose, and Throat Hospital, and in Charge of the Ear, Nose, and Throat Department; Professor of Otology, Rhinology, and Laryngology in the New Orleans Polyclinic; President of the Orleans Parish Medical Society; Fellow of the American Laryngological Association, etc.

With a view of facilitating the application of electricity for medical and surgical purposes, and at the same time economizing in the cost of using this agent, I have had constructed an improved electrical cabinet, for which I claim, after one year's daily use, the following advantages: Reliability in its action, precision in its application, convenience in the varied uses for which it may be adapted, and economy in the motive power. Although primarily constructed for my needs in the treatment and investigation of diseases of the ear, nose, and throat, it may, without any change in its mechanism, be adapted to all the present requirements for which electricity is used in medicine and surgery.

The cabinet contains arrangements for generating the current required for heating electro-cauteries of all sizes, for operating the drill motor, for lighting up small lamps of all kinds, and for applying the various forms of faradic and galvanic currents. In the application of each of these methods there are new and special features, which render the cabinet of more than ordinary importance. The cabinet very much facilitates the use of the electro-cautery. Instead of using the direct current, as is almost universally the case, an alternating current of low tension is used, as will be explained later, which adds considerably to the life of the cautery point. By means of the rheostat M (fig. 2) the current may be regulated for cauteries of all sizes, and the heating and cooling of the cautery points are regulated by pressure on the foot piece. The drill apparatus also has special features which make it valuable to the surgeon. The capacity of the motor, being one-quarter horse power, will give sufficient power for operating in all kinds of surgical work for which the drill and trephine are adapted, and the working of the motor may be so adjusted that a speed of from 1,500 to 6,000 revolutions per minute may be attained. Of special value is the power of the foot piece to control the operations of the drill, as, by means of an automatic brake, the drill may be instantly started or stopped at the will of the operator by a simple movement of the foot piece. The current for lighting up miniature lamps, such as Vohsen's, Trouvé's, Trautman's, and Heryng's, etc., is controlled by a rheostat, so that lamps of either higher or low resistances may be used. By connecting wires with the binding posts of the cabinet the current may be conveyed to a specially designed "dark room," where it may be controlled by a simple switch. This method I have adopted in my office, and find very convenient in the examination by transillumination for diseases of the maxillary sinuses. The induced currents which may be obtained from the cabinet are six in number: The primary (induced), the secondary, the combined primary and secondary, the alternating primary, the alternating secondary, and the combined primary and secondary alternating. Any one of these currents may be obtained by a movement of the lever of the current selector E (fig. 2), the strength of the current being regulated by means of the lever R in connection with the indicator. The variety of these currents and their range of strength allow a wide latitude for their adaptability in electro-therapy. The galvanic current supplied by the cabinet contains in its circuit a water-rheostat, a milliampèremeter and polarity-changer. By means of a special device the current supplied is protected from the dangerous influence of high currents potentiality from outside wires, which may acci-

dentally fall across the wires which furnish the current to the cabinet. This device also allows of delicate adjustment of the current, so that a strength of from one-tenth of a milliampère to 500 milliampères may be used. The important mechanism of the cabinet is a motor-dynamo, upon the action of which much of the capacity of the cabinet depends. As the name implies, a motor-dynamo is both a motor and a dynamo. Its special function is to transform an available existing condition of direct electrical pressure and volume into another ratio of pressure and volume which may be required for special work. This motor-dynamo was adopted for several reasons, prominent among which is that of obtaining currents of low potential, free from the dangers and cost of using a 110-volt current from the Edison mains direct.

There is a great loss of energy to use a current having a potential of 110 volts in cautery work, when a 5-volt current will do the work, the ratio being 5 to 110; that is, we are wasting $\frac{105}{110}$ of the total energy passing through the circuit, and utilizing only $\frac{5}{110}$ in the heating effects upon the cautery. The manner in which we economize energy by means of the dynamo-motor is very simple. By its agency we take, for instance, a current of two ampères at 110 volts pressure, and transform it into mechanical energy (loss about 10 per cent during conversion) or rotary motion similar to that of any ordinary motor, which motion, being transmitted to a shaft carrying another armature of similar construction, but wound differently, enables us to obtain a corresponding reduction in electrical pressure and an increase in the volume of currents flowing in direct proportion to the decrease of this pressure. On this principle, if we take a current of 2 ampères at 110 volts, and reduce this to 5 volts by conversion, we obtain 44 ampères of current at 5 volts, with no greater expenditure of mechanical energy than is represented in the first case, except such losses caused by friction in the parts, self-induction, and eddy currents, which do not exceed 10 per cent for each conversion, making a total of 20 per cent for the whole apparatus. Although in the construction of the motor-dynamo 2 independent armatures, 110 and 5 volts, respectively, are used, yet there is but one pair of field magnets, which envelop both armatures at the same time, which is a saving in the first cost of the apparatus, and likewise economizes the amount of current required to excite them. The side marked A (fig. 3) represents that part of the field magnet covering the motor armatures, and to the right of this is the commutator, by which the Edison current at 110-volt pressure is admitted. This causes the motor to revolve and thus gives the shaft a definite rate of speed. The dynamo armature, being attached to this shaft, is caused to rotate at the same rate of speed as the motor armature, and also in a field, always of the same strength. The dynamo armature, by its rotary speed and power, generates a current of low pressure and great quantity, such as is necessary for cautery work, and this current is delivered to the commutators, B^1, B^2, and B^3, the first two being alternating currents and the last a continuous current, all having the same potential. B^3 therefore gives a continuous current that is available for operating the induction coil with the interrupter in circuit, and from the commutators, B^1 and B^2, we draw an alternating current which is here used to heat the electro-cauteries, and also to operate the induction coil without the use of the interrupter. It has hitherto been the practice of different makers when constructing dynamos of low-tension currents to generate and make use of those currents flowing in one specific direction called "continuous;" but in this apparatus this process is reversed, a current which alternates about 6,000 times per minute being used. This current, on account of the rapid change of polarity, secures a longer life to the electro-cauteries than when they are heated by a continuous current. It is a well-known fact that the side of any incandescent conductor through which the positive enters will waste away more rapidly than the negative side, and for this reason it is desirable to equalize this action in using the electro-cauteries. The

principal reason, however, for employing the alternating current in this connection is that it enables us to use a commutator having no openings or divisions in its periphery, thereby excluding the possibility of sparking, a point of great importance, as it concerns the life and correct working of one of the vital parts of the apparatus. Sparking is one of the great causes of cutting and destructive wearing of motor and dynamo commutators. For this reason carbon brushes are used throughout the apparatus to the entire exclusion of copper, experience having taught that nothing can equal carbon for this purpose in the present state of our knowledge.

The objection to copper brushes lies in the fact that both the commutators and the brushes being metallic, the current (especially such a heavy current) has a tendency to fuse their surfaces together; as the continual rotation will not permit this, particles are torn off continually, causing what is known as "cutting," which in some cases may become so great as to wear out a new commutator in a few hours. Carbon, being nonmetallic, can not be fused to the rotating commutator, hence its superiority for this purpose. There are 14 brushes used in this apparatus, and were they of copper there would always be difficulty in getting the machine to work smoothly and successfully.

The motor-dynamo of this cabinet is capable of furnishing mechanical energy to the extent of one-quarter horse power. At the end of the shaft F (fig. 3) there is a small apparatus called an "automatic brake," the object of which is to start and stop the power from the motor-dynamo to the belt G, which operates the drill engine at the will of the operator, and is controlled by what is called a "foot piece." The automatic brake consists of five essential parts, marked, respectively, 1, 2, 3, 4, 5 (fig. 3), of which 1 and 2 are electro-magnets; 3 a keeper actuated by them; 4 a sleeve carrying a pulley at one end and the keeper 3 at the other and free to move longitudinally on the shaft F within a limited scope; 5 is a friction cone fastened permanently to the shaft F, and therefore rotating with it. H is an outboard bearing made of hardened and accurately ground tool steel, and is put there for the purpose of steadying the shaft F and to prevent undue side strain from the action of the belt G. J is a hardened and ground steel collar and washer which receives the thrust due to the pressure of the brake magnet (2). On examining the top board of the apparatus (fig. 2) there will be seen a set of three binding posts called "foot piece," and marked 2, 0, 1; they serve for the double purpose of actuating the brake by means of the foot piece and controlling the cautery current, both being operated with the same foot piece.

In this connection the current selector is used. This has eight contacts, marked respectively, "Engine," "Cautery," "Interrupted primary," "Interrupted secondary," "Interrupted primary and secondary," "Alternating primary," "Alternating secondary," "Alternating secondary and primary." The connections are so made that when the handle of the current selector is placed over the word "Engine," the cautery and induction-coil currents will be automatically cut out and can not be used while the engine is in operation. This provision is necessary because the engine may be run at a variable speed by means of the switch K, but these variations would seriously hamper the use of the cauteries and induction coil. To illustrate this, suppose two operators desired to use the engine and cautery at the same time, and let us suppose that the apparatus were so constructed as to permit of such use. If, then, the operator using the engine adjusted the engine at the lowest speed, and the other operator at the same time employed a small cautery, which he brings to the proper degree of heat by means of the switch M—if, now, the first operator desiring to increase the capacity of his drill, increases the speed of his engine by moving the lever at K, the dynamo will simultaneously increase the strength of the current supplied to the electro-cautery, which would probably be at once burned out. When the apparatus is used

for cautery purposes it is requisite that the starting switch K should be at full power on contact 5, and the current selector must be on contact marked "Cautery," and when in this position the foot piece attached to the binding posts 2, 0, 1 will be cut out from operating the brake and the engine belt G, but will simply put the current on or off the cauteries attached to the cautery binding posts. A forward motion of the foot will turn on the current, and a backward motion will cut it off. The action of the foot piece is the same when the selector handle is on contact marked "Engine," but instead of operating the cautery it clutches in or out the brake pulley or shaft F, causing the cable with its drill to rotate or stop instantaneously, according to the will of the operator. In the automatic brake this is accomplished by means of the magnets 1 and 2 (fig. 3). When the current is turned on the magnet 1 it is at the same instant cut off from magnet 2, the result being that the sleeve carrying the pulley 6 is attracted toward magnet 1, and pressed firmly against its surface with a tension of about 50 pounds. When the foot piece is pressed forward the current is cut off from magnet 1 and is transferred to that of 2. This causes the sleeve to press forward, but this time it does not reach the face of magnet 2, being arrested by the pulley 6 coming in contact with the friction cone 5 fastened to the shaft F. This at once causes the pulley to acquire the speed of the shaft, to be again checked when the foot piece is depressed backwards and the keeper 3 is brought in contact with the face of magnet 1. The binding post O is common to both magnets 1 and 2, and therefore there are but three wires in the foot piece.

The current which operates the electro-cauteries does not pass through the foot piece, as this extra resistance would be important to a current having a potential of only 5 volts. Instead of this, the constant current from the dynamo is passed to the foot piece, which operates a magnetic circuit closer, through which the alternating current which heats the cauteries, is passed. When the foot piece is pressed forward the constant current passes to the electro-magnet of the circuit closer and the switch is drawn down, allowing the alternating current to pass to the cautery. When the foot piece is depressed backward, the switch of the circuit closer is released, and the alternating current no longer passes to the cautery. The foot piece thus serves a double purpose, that of controlling the engine and the cautery, and either one may be used according to the position of the current selector E (fig. 2). The cautery can, however, be used at the same time as any of the induction coil currents, and the cautery may still be used when the selector handle is over any of these contacts. The only time that the cautery can not be used is when the engine is used, for the reason already explained.

When the motor dynamo is used to operate the engine, it may be used at any speed within the limits of the rheostat K, but when it is used to operate the cautery, or induction currents, it should be used at full speed, the lever of the rheostat K being on the point 5. The cautery currents are taken from the binding posts marked "Cautery" on the top board of the apparatus, and the faradic currents from the binding posts marked "Faradic." There are six forms of faradic currents generated in this apparatus, all of which are available from the same pair of binding posts, thus avoiding the inconvenience of selecting a new pair of binding posts each time that a different current is required. The current that the operator desires to use is carried to the binding post by means of the lever of the current selector E, which is placed over the contact marked "Primary," "Secondary," etc. The indicator for faradic currents (fig. 2) is operated by the small handle, R, in front of the apparatus, and its object is to indicate the relative immersion of the primary into the secondary coils of the induction coil proper, which is made up of a number of coils so as to permit of the use of simple and complex currents. This indicator serves for all six currents, and, by means of a handle, R, the strength of the current can be very accurately graded to suit the require-

ments of the case. Although the scale is an arbitrary one, still it enables the operator to keep a record of the number of degrees required to give the best results to the patient, and enabling him to use the same strength that was found efficient on a former occasion. P is the rheotome, and is so arranged that it can be adjusted to coarse or fine vibrations by turning the screw of the contact point. X X are oil cups on the motor-dynamo, which require filling regularly. The commutators should be kept clean, and a little vaseline rubbed on the wearing surfaces as a partial lubricant and to deaden the vibrations of the brushes. The motor-dynamo is held down to the bottom of the cabinet by its own weight only, and it rests on six gum washers so as to prevent undue vibrations of the floor and surroundings. The belt G, after leaving the pulley of the motor-dynamo, travels upward and passes over the pulleys marked 1, 2, 3, 4, 5, the pulley 5 being the one attached to the regular S. S. White engine cable and hand piece, the general design of which is shown in the plan (fig. 2). The pulleys 2 and 3 are attached to the sliding arm, and serve the double purpose of taking up the slack of the belt when the arm is slid in or out, thus preserving at all times the same degree of tension in the engine belt G. The engine arm S is capable of turning on a center, from side to side, and the center of motion is so adapted that the belt is always in its radius, and thus never suffers any distortion or strain and can not fall off unless it is loose. Whenever the belt is too loose for proper work the small sliding head, to which the pulley 4 is attached, may be moved forward until the belt has the proper degree of tension. The engine cable head, marked 6, can also be rotated on a common center to the extent of half of an arc of a circle. The cable itself has all the movements commonly given to these devices by the S. S. White Dental Company. V, V, V, V, V are drawers for instruments, electrodes, flexible cords, etc. T is a quick break-switch which cuts all the current from the apparatus when not in use. The engine switch K is also fitted with a quick-breaking attachment, so that as the lever leaves the last contact the circuit is broken with a quick snap, thus preventing the possibility of arcing and its consequent injury to woodwork and the metallic contacts forming part of the circuit. The miniature lamp switch U (fig. 2) receives its current directly from the Edison mains, and is not dependent upon the motor-dynamo for its energy, and the current from this is conveyed to the binding posts marked "Lamp." This lamp circuit is so arranged that the current is drawn from the Edison mains in shunt, and not in series, as is usually done. For this purpose the current from the Edison mains is passed through wire resistance of great length and fastened in coils to the back part of the cabinet. By tapping this wire at different points of the circuit by means of lamp switch U (fig. 2) we obtain a current of sufficient intensity to produce incandescence in the miniature lamp connected with the binding post marked "Lamp" (fig. 2). By means of this shunt system we avoid the sparking incident to using the current when the lamps are placed in series. Z Z are the binding posts, to which are attached the wires leading to the Edison mains. The action and details of the foot piece used in this apparatus are shown in the plan (fig. 2), and require no extended description here. T is the main switch of the galvanic current.

As the tension of the Edison current (110 volts) is too high to make it convenient for the delicate adjustments required for galvanism, and as, moreover, the direct current is not free from a certain element of danger, such as the crossing of the wires with an outside wire carrying a current of high and dangerous potential, I have introduced into the cabinet an arrangement devised by my assistant, Dr. Scheppegrell (New Orleans Medical and Surgical Journal, January, 1893). In this arrangement the direct current is passed through a number of lamps, which divide up the difference of potential, and by means of a volt selector a shunt current is taken from the lamp circuit, varying in strength according to the position of the volt selector. If, for instance, the current be passed through four lamps

of equal resistance the tension of the current will be divided into four equal parts, and by adjusting the lever of the volt selector we may make use of a current of 27½, 55, 82½, or 110 volts, respectively, thus allowing of more accurate adjustment of the current. As there will be less resistance through the lamp than through the water rheostat and patient, this shunt arrangement forms a safeguard to the patient from extraneous currents. The current, after being adjusted by the volt selector, is regulated by means of a new Bailey rheostat, the strength of the current being shown by the milliampèremeter. A polarity changer is used for reversing the polarity of the electrodes.

In regard to using the motor-dynamo for heating the electro-cauteries it has not only the advantage of convenience and economy over using the Edison current direct, but also the important item of safety. Let us suppose a case where the surgeon has a patient in his chair and is operating on any part of the body with a cautery electrode carrying a 110-volt current, and while doing so a wire in the street, carrying a current of from 500 to 2,000 volts, should become accidentally detached and fall upon the lines leading to the office. This would injure the patient severely, and is an accident that happens quite frequently to all electric-light circuits, the central-station dynamos being sometimes burnt out from this cause.

By the use of the motor-dynamo system the patient is not brought into contact with the Edison circuit direct, and should any outside wire fall on the wires, as described above, it can only result in blowing out fusible plugs by which the motor-dynamo is protected from heavy currents. Another element of danger to be considered lies in the use of a current of such a high potential as 110 volts for cautery work, outside of any consideration of the question of cost. Suppose you have an electrode in the circuit that requires a current of 22 ampères; this will, at a pressure of 110, consume an energy of over 3 horse power. Now, should the cautery suddenly break from any cause, while it is being used, there will be formed a heavy arc, which would destroy all tissue within one-quarter radius of the arc so formed. A current of 22 ampères at 5 volts, such as is supplied by the motor-dynamo, could not give rise to an arc that would in any way be dangerous to the patient. The engine can be operated at from 1,500 to 6,000 revolutions per minute; is adapted for using all kinds of drills and other attachments, and can be stopped within the one-tenth part of a second while making 6,000 revolutions per minute.[1]

DISCUSSION.

Dr. E. Fletcher Ingals, Chicago. I would like to ask Dr. de Roaldes how much his apparatus costs, and I would put the same question to Dr. Hobbs. I would also like to ask Dr. Hobbs if his apparatus can be applied to the powerful currents we have in the larger cities, as well as to those in the smaller ones. I would like to ask Dr. Hobbs whether his instrument allows him to use the current for anything else except the galvano-cautery.

Dr. D. Bryson Delavan, New York City. This is one of the most important subjects that could be brought before us, because one of the newest, and while I fully sympathize with those who have spoken of the expense and extravagance of experimentation in electrical matters, I still think we are advancing in that line and that our trouble in past years has not been thrown away. We seem to have arrived at this basis, viz: That the street current is available for our uses. This has been shown for several years and every season brings up some new and

[1] I take great pleasure in thanking publicly the Messrs. Buchel Bros., of the Buchel Machine Works, New Orleans, who have exercised the greatest mechanical skill and technical knowledge in constructing this apparatus.

improved plan, device, or apparatus by which the street current can be utilized. The great desideratum in regard to it is, first, that we shall be allowed to use it with safety; second, that we shall be able to adapt it to the widest variety of uses; and, third, that in the adaptation of it to this variety of uses we shall not be put to too great expense. The addition of a single department of electricity, the faradic current, for instance, will materially increase the cost of such an apparatus as this, and so with the addition of any other distinct branch. For a man of small means, who has not a very large practice, it becomes a question whether it would pay to try to combine all the uses of electricity in one apparatus, or whether, on the other hand, it would not be more economical to combine several immediate uses in one instrument, perhaps, and supplement that apparatus by other independent instruments. For instance, if we wish to employ a galvanic current for electrolysis or the simple therapeutic use of galvanism, it might be much better to purchase an ordinary galvanic battery and use that, depending upon the street current for other uses. It is extremely difficult to advise others as to what electrical apparatus to purchase.

In my office, while using the street current for lighting, I have an arrangement made by the Edison Company, a series of primary cells, the so-called "Edison-Lalande," which work well, are economical and durable, and on the whole are the most satisfactory of the kind I have ever seen. However, when that happy day comes, and let us hope it is arriving now, that we can convert the street current to all uses at not too great an expense, it will be a desirable thing to do away with all subsidiary apparatus and confine ourselves to one source of power. There is only one serious objection, aside from the expense, to these complicated instruments, and that is every additional complication, every additional connection, switch, etc., put upon a given instrument is liable to increase by so much the possible chance of accident, and unless the instrument is very well constructed and access may be had to the services of a thoroughly competent electrician, the more complicated instruments are not so desirable. The others certainly have a place with residents of the smaller cities and places remote from the centers of electrical information. Although I have the greatest admiration for the instruments that have been presented this morning, it seems to me that as yet the universal electrical apparatus has not been presented. By universal I mean adapted to the largest number of purposes and brought within the means and easy handling of the largest number of men. It is certainly a cheering fact that we have had this morning brought before us two instruments which suggest so much that is valuable and which have gone so far toward solving the large number of difficulties which we encounter. It is to be hoped that before long, from these ideas and those that have gone before, an instrument may be evolved which will answer all purposes for all men.

Dr. A. W. de Roaldes, New Orleans. I think Dr. Cohen can rest assured that from this time on if he wants to procure either one of the two apparatuses which have been described here, he will have no cause for investing further in electrical instruments that will have to be put aside after spending a great deal of money on them, as has been the experience of all of us for the last ten years. The motor-dynamo and very complete electrical cabinet which I to-day bring before you can not be said to be a cheap apparatus, owing to the fact that a good deal of money was expended on it for experimental work. But now that this experimental stage is over and the mechanical work well defined, this apparatus could, I believe, be duplicated for much less money, say a sum between four and five hundred dollars. Such an outlay, made by a specialist who has a large practice, and consequently reason to make use daily of the different parts of the cabinet, will, in the long run, be found to be a profitable investment. The cost of running is so insignificant that I have found the electrical company which supplies the direct current for the motor unwilling to furnish me with a special meter. I

had, therefore, to submit to a minimum tariff of $3 a month, which, however, includes the current for the illumination of several rooms. Of course my apparatus is much more costly than the one described by Dr. Hobbs; but remember also that, besides a galvano-cautery, it embodies, in a neat and compact cabinet, a drill, as well as all the different forms of currents for medical use and for electrolytic work. In addition, with the ingenious little apparatus of our colleague, Doctor Hobbs, there is a considerable loss of energy, even when using only a current of 52 volts. This has been obviated in my cabinet by means of the motor-dynamo, as already explained. When considering the cost of the apparatus one must also consider the wide range of electrical applications which it furnishes in a neat, compact, reliable, and economical (as to running expense) form. You have first an electrical drill as a part of the apparatus, with such an arrangement as no other electrical drill offers, an automatic brake that will allow you to start or stop the drill almost instantaneously (within ten seconds). Its power is equal to one-quarter horse, which is sufficient to do any kind of surgical work. The galvano-cautery is so arranged as to heat at will the smallest cauteries for ear work to the heaviest knives, the control of the current being transferred from the handle to the foot piece. You have in addition all the varieties of the faradic current, with an improved scale of measurement, and a finely graduated galvanic current available for medical use or for electrolytic purposes. This apparatus with its different combinations will allow you to utilize the current of the street for any purpose in medicine and surgery, and while it was originally designed solely for my special work, it is practical for the general surgeon. If the different parts contained in this cabinet were to be obtained as separate electrical apparatuses I doubt very much whether the aggregate expenditure of money would not be as great. The running expenses would certainly be greater. As to the reliability of this motor-dynamo and electrical cabinet I will only say that the guaranty of one year has expired without having to call on the expert electrical engineer who built it. The apparatus was so well constructed that at no time in eighteen months of daily use has there been a single part out of order. The only attention it requires is on the part of my office nurse, who keeps the cups properly supplied with oil.

Dr. Arthur Hobbs, Atlanta, Ga., in closing the discussion, said:

Yes. It will charge a magnet; it will give a light to the small incandescent lamps, either for direct or translucent purposes, which could not be gotten directly from the street wire. Electrolysis can not be obtained from an alternating current; it would neither reduce the electro-motive force nor the ampèreage sufficiently for this purpose. The cost of the cautery through this little apparatus is practically nothing; possibly as much as 10 cents per month. The only cost is that of the wire, which you would already have in your office for light and power before attaching the transformer. I am not sure of the cost of this transformer. My electrician has, however, assured me that it will not cost over $30 or $35. The only transformers now in use are the three in my own and assistant's rooms. I think $35 will be its probable cost. I would not sell mine for $1,000 if I could not duplicate them. The current must be alternating. The one best adapted to it is the 52-volt, but the 120-volt will do, or even the high power of 500 volts may be used by first distributing the force through five or ten lamps and motors before the current is carried through the transformer, provided it is the alternating current and the magnet and motors are properly adapted to it.

SOME OF THE THROAT CONDITIONS OBSERVED IN GOUTY SUBJECTS.

By SOLOMON SOLIS-COHEN, M. D.,

Professor of Clinical Medicine and Applied Therapeutics in the Philadelphia Polyclinic; one of the Physicians to the Philadelphia Hospital, etc.

The term "gouty subject," as used in this paper, has perhaps a somewhat wider range of meaning than can strictly be ascribed to it, if only those are to be termed gouty who have suffered with articular inflammation, or who exhibit characteristic deposits. In this country, at least, a much larger number of persons suffer with other than articular manifestations of the uric-acid diathesis, their symptoms being varied, and often obscure, until the cause is discovered upon examination of the urine, which shows more or less constantly an excess of urates and uric acid, and often contains calcium oxalate and excess of phosphates. In both classes of patients the upper air passages are frequently affected, and while the gouty diathesis can not be affirmed to be the sole cause of the local manifestations, it doubtless acts as both a predisposing and a modifying influence.

Harrison Allen[1] has sharply discriminated between gouty sore throat and the lithemic throat, and has reported a number of instances of the former condition. He has also given such references to literature as are of value in this connection. I am not inclined, however, possibly because of a more limited experience, to make equally sharp distinction with Allen. Sir William Roberts[2] has well shown the important difference between uric-acid gravel and gout, the offending materials in the latter case being deposited in combination as urates in the true interior of the body, while in the former they are deposited as uric acid, on a doubling of the external integuments; yet even he admits that the underlying conditions are virtually the same. Reasoning upon clinical analogy and without direct histologic evidence, it seems to me that cases of the class treated of in this communication occupy what may be termed a middle position, the phenomena depending in large part upon irritation due to offending materials in the circulation, but in less part upon actual deposition in the fibrous tissues.

A large number of cases would have to be recorded in detail by different observers, and a careful analysis made, before characteristic signs of throat gout could be laid down. Reference should be made to the valuable studies of Hinkle,[3] with whom, however, I can not agree in assuming that the cases reported by Ingals as instances of rheumatic sore throat were of a gouty nature. This paper does not aim to present more than the general results of personal observation extending over a number of years, but necessarily dealing with a limited number of cases. The condition, depending as it does upon a permanent error of metabolism, is probably in most, if not in all, instances a chronic one, with a tendency to paroxysmal exacerbation, under the influence of extrinsic or intrinsic exciting causes. Among the most frequent of such exciting causes are exposure to cold or to wet and indiscretion in diet.

The frequent dependence of chronic sore throat on diathesis has been recognized by systematic writers. Thus, concerning the causation of "chronic catarrhal sore throat," J. Solis-Cohen says:[4]

The disease is not usually a sequel of acute sore throat, but becomes gradually developed without attracting much attention. It may exist with any diathesis. Sometimes it is a mere manifestation of disorder in the intestinal tract.

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[1] The Medical News, Philadelphia, June 16, 1888.

[2] Sir William Roberts, on the Chemistry and Therapeutics of Uric-acid Gravel and Gout, p. 56. London, 1892.

[3] Trans. Am. Laryngological Association for 1889, p. 124. New York, 1890.

[4] Diseases of the Throat and Nasal Passages. Second edition, p. 178. New York, 1879.

And again, concerning treatment, he remarks:

As this affection may coëxist with a variety of diatheses, the systemic treatment will vary in accordance with the constitutional requirements. Alkaline laxatives are usually indicated.

Attention being as a rule first directed to gouty sore throat during a paroxysm, its diathetic origin may be overlooked; and the case may be mistaken for one of the ordinary forms of acute inflammation. Inflammation, however, is not a necessary feature of the disease, and in my own experience the most prominent symptoms have been sensory; pains and perverted sensations of various kinds being referred to circumscribed regions, often described as "spots," in which no structural alteration adequate to explain the symptoms can be discovered. In one of the most marked cases that has come under my observation, that of a married lady, some 45 years of age, who is of a gouty family and has gouty deposits in the finger joints, the spot most frequently pointed out as the seat of the discomfort is in the left pharyngeal angle just behind the free border of the soft palate. This, however, is not the only location of pain, which is variously described as stinging, burning, pressing, or like that caused by the presence of a foreign body. Sometimes the discomfort is referred to the neighborhood of the epiglottis; sometimes to the side or the base of the tongue; sometimes to several points at once. These spots are often painfully sensitive to the touch, and can thus be accurately localized. The patient has an idiosyncrasy to cocaine, and it could not therefore be determined whether or not the application of this drug would abolish the localization of pain. Similar localization is found in many, but not in all cases, and usually fails when cocaine has been applied, though this is not invariable. I have been of the opinion that when sensitiveness persisted after application of cocaine the trouble was deep-seated in the fibrous structures. In some cases pain is referred to a part apparently unrelated with the one touched, but the association is constant, and the impression left upon the mind of the observer is that the error is in the reference, few persons being able to describe accurately the exact seat of a sensation in the throat.

Sometimes, and more especially during an acute paroxysm, visible alterations of structure are manifested at the painful spots. The most usual appearances are the presence of dilated blood vessels; veins or capillaries, several of which may cross one another at such a spot. Sometimes a single large blood vessel is found; sometimes there is a dusky coloration of the mucous membrane; sometimes an enlarged and reddened follicle. Often, however, there is no apparent difference from the surrounding membrane, which sometimes presents general congestion, and sometimes nothing out of the ordinary. When congestion exists it may be patchy or uniform. Usually the coloration resembles that of corned beef; sometimes it is dusky red, or even purplish. In the larynx, the epiglottis and the arytenoid eminences seem the favorite seats of morbid sensation, the former usually exhibiting a network of dilated vessels resembling a veil, the latter a slight tumefaction and reddening. In two cases, in young men, I have seen what appeared to be inflammation limited to the neighborhood of one crico-arytenoid joint There was pain on respiration and phonation, vaguely referred to this region. I have frequently seen similar appearances at the inception of an attack of acute rheumatic tonsilitis. In some cases there is during the more acute stages a characteristic diffuse laryngitis, much resembling, and perhaps identical with, the form described by J. Solis-Cohen[1] as occurring in young adults addicted to overfeeding and the abuse of condiments. In these subjects the tongue is red or reddish-brown, thick, puffy, with prominent papillæ, with a somewhat thick coating at the base, extending in streaks

[1] Diseases of the Throat and Nasal Passages. Second edition, p. 474. New York, 1879.

toward the tip. The mucous membrane of the pharynx, palate, and palatine folds is relaxed, puffy, and usually congested. The mucous membrane of the larynx, and especially of the arytenoid eminences, and of the ary-epiglottic folds, is similarly puffy and always congested; the vocal bands are pink or red, the color being deepest at their posterior insertions. A pellet of mucus is usually adherent to the meso-arytenoid fold, and as a rule mucus is found in other portions of the larynx as well. The voice is hoarse; the hoarseness is greatest in the morning and after meals. There is a constant desire to clear the throat of mucus; the expectoration is greatest in the morning. The patients often complain of a feeling of fatigue after slight use of the voice. This sensation of tiredness may be referred to the larynx or to the pharynx. The conditions described may pass off in a few days; they may persist for ten days or a week; or they may merge with the chronic symptoms.

In the pharynx, the tonsillar and peri-tonsillar structures and the angles of junction of the posterior and lateral walls have seemed to be most frequently affected. There may be enlarged glands. The tongue and its glands are often involved. The mucous membrane of the tongue or of the cheeks sometimes presents whitish patches of cornified epithelium (leukoplakia buccalis). When the distressing sensations are referred to the rhino-pharynx, Luschka's tonsil may be tumefied and reddened. In young patients the pharynx and larynx are often covered with grayish, tenacious mucus; in those past middle life the pharyngeal and palatal membrane is often dry and pale, exhibiting a network of enlarged and tortuous vessels, or mottled with livid patches.

Relaxation of the palate is common, and in some subjects paroxysms of nasal obstruction, with or without coryza, are met with. This was noticeably the case in a man aged 54 years, a neurasthenic, with gouty deposits in the drum membrane, and in whom at other times nasal respiration was perfectly free; there being no structural deformity that would impede the passage of air. During these paroxysms of obstruction the turbinates would be puffy and pasty looking; the posterior wall of the pharynx would be apparently bulged forward, and the soft palate would likewise appear puffy and pale. There would be an annoying sensation of a foreign body between the throat and the nose, and efforts at hawking, though ineffectual, would be continually repeated. Examination would not reveal sufficient accumulation of mucus in this region to account for the sensation. In this case the hard and soft palate were occupied almost constantly with a network of large, bluish vessels, which during the paroxysms referred to became still more tortuous and darker in color. Upon one occasion I proposed scarification, but the patient—perhaps wisely—would not consent. In some cases tubal catarrh exists and sensations of distress are referred to the ear. In a case similar to the one just cited, pain was referred to a point marked externally by pressing the finger just behind the angle of the jaw, whence it radiated into the ear. In a few cases spasmodic choking in swallowing and spasmodic obstruction of respiration, laryngeal and bronchial, have been observed. In one case an attack almost resembling croup was followed by an outbreak of articular gout.

The diagnosis in these cases, while suggested by local appearances and symptoms such as have been described, depends upon recognition of the constitutional condition, and can not be affirmed in the absence of the ordinary evidences of such constitutional disorder. Urinalysis gives the most important evidence in cases in which there has been no articular inflammation or deposit.

Local treatment is palliative only and it should be sedative and protective; irritating and stimulating applications are counter-indicated. Astringents may be cautiously employed during exacerbations. For this purpose I have found the glycerole of tannin applied by cotton wad, or a spray of zinc sulpho-carbolate in rose-water (5 grains to the ounce), the most useful. Cocaine is badly

borne by some patients, inducing spasmodic phenomena. When well borne it is useful to relieve pain. Applications of fluid extract or concentrated infusion of coca will at times be feasible and useful in cases in which the alkaloid can not be employed. I have likewise found aconitine oleate (2 per cent in oleic acid, freshly made and flavored with oil of almond) a useful analgesic application. Menthol (from 2 to 5 per cent in liquid petrolatum, as a spray; from 5 to 10 per cent topically by cotton wad) is occasionally of great service: in some cases, however, it can not be tolerated. Bromoform (topically by cotton wad) has given relief in one or two cases in which other applications were inadmissible. In chronic cases solution of iodine and carbolic acid in glycerin (of each 1 grain to the ounce, with 1½ grains of potassium iodide to facilitate solution) applied to the spots of painful sensation, or brushed over the entire pharyngeal wall, is of service. Before making any of these topical applications, whether in acute or chronic cases, the parts should be cleansed by an alkaline and aromatic spray. In quite acute pharyngitis a gargle of hot milk and borax, or of plain hot water, or hot alkaline solution, often gives great relief. Guaiac is likewise of benefit. In acute laryngitis alkaline sprays, followed by the inhalation of the vapor of hot water impregnated with benzoin and paregoric, are useful. For permanent relief, of greater or less degree, dependence must be placed on dietetic, hygienic, and medicinal measures appropriate to the uric acid diathesis. It is unnecessary to detail these here, but I would like to record my favorable experience in this connection with strontium bromide.

ILLUSTRATIVE CASES.

Case 1.—Mrs. L., aged 50, for some years has had attacks of tingling and sensations as of the presence of dust (hardly intense enough to suggest the presence of a feather) at the left side of the throat. When this feeling is experienced she is forced to cough, and with the cough comes a sensation of strangling. The cough is short, at first sharp, afterwards, with the strangling sensation, muffled. There is never any expectoration. The pharyngeal mucous membrane is irregularly reddened and thickened, and there are a number of prominent follicles, surrounded by reddish whorls of dilated vessels. The larynx is diffusely congested, the color being deepest over the arytenoid eminences. There is no mucus in the larynx or pharynx; Luschka's tonsil is reddened and prominent. There is no turbinate engorgement, and though the septum is slightly deflected to the left, nose breathing is, and has always been, free. The patient has frequent attacks of shooting pains in the finger joints and about the knees. There are gouty changes in the last joints of the ring and middle fingers of the left hand. For some years she has been compelled to rise at night to urinate. The urine at times is burning. The patient belongs to a family of good livers, some of whom have had articular gout. She is very stout and has a sallow and flushed complexion. Urinalysis showed the presence of free uric acid, as well as excess of urates and calcium oxalate. The specific gravity was high. No sugar or albumin was found. A spray of liquid petrolatum, with 5 per cent of menthol and 2 per cent of cocaine, was prescribed to be used three times a day and whenever the unpleasant sensations were experienced. The diet was carefully regulated, outdoor exercise directed, and strontium bromide given in doses of thirty grains three times a day before meals. Under this treatment the patient rapidly improved, and up to date (ten months) there has been no return of the paroxysms.

Case 2.—Mr. M., aged 52, of full habit, sallow and flushed complexion, complains of ringing in the ears, of a pain darting from the ear to the throat, and from the throat to the ear, sometimes felt externally behind the angle of the jaw. There is a constant desire to clear the throat, but very little mucus is ejected. The nose feels stuffed up. At times there is a burning sensation referred to a definite spot in the pharynx. The palate is relaxed and covered with a network of bluish vessels. There are a number of enlarged follicles in the pharynx, which is irregularly streaked with red and bluish patches; between these the intervening membrane is quite white. A sensitive spot is found just beneath one of the enlarged follicles on the posterior wall. The patient recognizes this as the seat of the burning. There is considerable tumefaction of the posterior wall of the pharynx toward the lateral angles. The septum is slightly bent, though not suffi-

ciently to obstruct respiration, and the lower and middle turbinates are red and swollen. The tongue is heavily coated, and the papillæ are prominent. Some accumulation of thick, tenacious mucus is seen in the vault of the pharynx. The mouths of the Eustachian tubes are widely open, and the whole structure appears much larger than normal. No mucus is detected in the Eustachian tube and air enters it freely. The drum membranes are opaque and show gouty deposits. The patient is a dyspeptic; his urine shows excess of urates, calcium oxalate, no albumin, no sugar. A spray of menthol and cocaine in liquid petrolatum was prescribed, but the strength had to be reduced to 2 per cent of menthol. The rhino-pharynx was wiped clean every morning with a cotton wad, saturated with a 2 per cent solution of cocaine. Counter-irritation over the mastoid processes with tincture of iodine was from time to time employed, and iodine, carbolic acid, and glycerin solution applied twice a week by a cotton wad to the nasal passages. Regulation of diet and antilithic treatment internally were kept up. The patient slowly improved and was dismissed from treatment in the course of three months. He had become largely rid of his distressing symptoms, though not altogether of the roaring in the ears. Once in a while he returns for local treatment, which seems to give him relief.

Case 3.—Mr. C. H., aged 30, a traveling salesman, for a year or more has had frequent attacks of hoarseness, with a feeling of "rawness" in the throat. There is no pain in swallowing. The attacks last about a week. The intervals of freedom vary from a month to six weeks. The present attack has lasted longer than usual—some ten days. There is a slight, hacking cough and a desire to clear the throat. There is no trouble in breathing, nasal or otherwise. The tongue is heavily coated, the pharynx congested in streaks, the larynx slightly congested, the epiglottis flaccid, the arytenoid eminences puffy. There is pain referred to the upper part of the chest, but no physical sign of pulmonary lesion. The heart is normal. The patient is a very stout man. He uses tobacco largely and drinks beer moderately. He is a hearty eater and a gourmet. The urine is 1.034 in specific gravity, of acid reaction, and contains urates, uric acid, and calcium oxalate in excess. Diet was regulated. A solution containing strontium bromide and strontium lactate, 15 grains each, was given in water, before meals. The patient was ordered to drink hot water one hour before meals. Zinc sulpho-carbolate spray was applied locally. Relief was reported in four days. There has been no return of discomfort as yet.

DISCUSSION.

Dr. James E. Logan, Kansas City, Mo. I was very much interested in the paper, as I have given the subject some consideration within the last few years, and especially the relation the general practitioner should bear toward the throat specialist. I have found some cases very interesting in their nature that were only remediable through agents of general medication. Where I had tried local treatment, where examination revealed very little, if any, active inflammation in the pharyngeal cavity, there were possibly some little inflammatory points referable to the follicles of the tongue, especially where they come in contact with the anterior and posterior faucial pillars. That is one of the most aggravating of the painful points these patients complain of. There is another, to me, pathognomonic symptom in these cases; that is, a complaint of a tired sensation in the throat, and especially is this tired feeling experienced after a little excitement. In all these cases I have made the urinary analysis the Doctor speaks of and found the condition as he represents it. Not more than five weeks ago I had an elderly lady in my office who gave every evidence of this condition from the urinary analysis. I found her very apprehensive. The pain was so excessive and aggravated that she could hardly realize that it was other than the most malignant type of disease. I assured her this was not the case, and put her on an antigout treatment and a mild astringent—the sulphate of copper—for its moral effect more than anything else. The patient was relieved in a little while. She had had one or two previous attacks, but not so severe, and she and her family got the idea that it was some malignant disease. I reassured her on this point, and found the case remediable through medicinal and not through local means.

Dr. J. H. LOWMAN, Cleveland. I think the subject of paræsthesia of the pharynx and larynx is interesting, because instances of that kind do come under one's observation where it is impossible to make a diagnosis. The question of paræsthesia of the pharynx in tuberculosis and paræsthesia of the larynx in gouty conditions may be distinguished by the color perhaps, but they run into one another so closely sometimes it is difficult to make a distinction. Not infrequently I have seen people who have complained of pains in the limbs and of a sensation as of a foreign body in the throat, where I could find nothing in the throat to explain the phenomena and could find absolutely nothing in the constitution to explain it, but have been able to trace it to tuberculosis later, the paræsthesia, by some accident in the career of the individual, manifesting itself first. It strikes me that paræsthesia in the gouty subject may be the same; the system is ready, and by some accident it appears. I remember an instance where the individual had this congestion and disease of the pharynx with occasional pains in the limbs and paræsthetic sensations, and then he had gouty urine, etc., and after any little excess of eating or drinking he would have most intense edema of the uvula; it would become as large as his thumb, and this would last from one to three days, then the throat would go back to the normal condition again. The edema of the uvula would be so great that it would have to be clipped; no remedies would have any effect upon it. I think the diagnosis is very difficult in paræsthesia.

Dr. S. SOLIS-COHEN, Philadelphia. Of course I did not go into the great subject of the diagnosis of paræsthesia; I recognize its difficulty. Nor would I be understood to imply that all cases of paræsthesia of the pharynx or larynx are gouty. I simply recorded my experience with a number of cases as being related with a uric-acid diathesis, and have confessed my inability to make a positive diagnosis by local signs in affirming that it can only be made by a recognition of the constitutional condition.

A CASE OF ANGIOMA OF THE NASAL SEPTUM.

By FREDERICK C. COBB, M. D.,

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The patient, Lizzie B., 15 years of age, came to the Out-Patient Throat Department of the Massachusetts General Hospital in October, 1892, complaining of obstruction of the right nostril and epistaxis from the same side. The duration of these symptoms was about six months. There had been no sneezing, and only occasionally a yellow, thick discharge from that nostril. She was anæmic, always subject to headaches, and exhausted by the least exertion. Her previous history, with the exception of an attack of scarlet fever six years ago, was negative. Examination of the anterior nares showed them to be normal on the left side. On the right side the nostril was wider, the turbinates slightly atrophic. Hanging from the septum by a thin pedicle inserted near the junction of the skin and mucous membrane, above the end of the lower turbinated bone, was a small growth divided into two lobes by a constriction about its middle. It was soft to the probe, moved backward and forward on inspiration and expiration, but was not seen to pulsate. At its lowest portion were a few small, black blood clots. The posterior nares, pharynx, and larynx were normal. With the aid of Hooper's snare and écraseur the growth was removed with very slight hæmorrhage. The base was not cauterized, the patient was given an alkaline wash, and returned two or three times until the site of the pedicle was completely healed, which occurred in about ten days.

She was examined in August, 1893, and has had no recurrence. The growth was submitted to Dr. Whitney, the pathologist to the hospital, and the following report

was received from him: "Growth with large vascular sinuses with more or less round cells about; cavernous angioma." In looking over the literature of nasal angiomata one is struck by the lack of pathological accuracy shown by the reporters of cases. If we inquire what is the structure of angioma, we find, according to Bosworth, that it is composed almost entirely of blood vessels held together by a slight network of connective tissue. Sutton, Ziegler, Birch-Hirschfeld, and other pathologists agree with this definition. Now, if the reported cases of angiomata be judged by their pathological examinations, we shall find, I think, that a pure angioma of the nose is very rare. The importance of pathological accuracy will be evident when we remember that the prognosis may depend upon it.

Sarcomata and epitheliomata may contain small portions of nearly pure angiomatous tissue, and if such portions alone are removed for examination they may lead to very erroneous conclusions. The cases reported are those of Verneuil,[1] Wagner,[2] Steinbrügge,[3] Seiler,[4] Richet,[5 and 15] Roe,[6] Jarvis,[7] Vanderpoel,[8] Burckhardt,[9] Nelaton,[10] Huguier,[11] Panas,[12] Guyon,[13] Dumenil,[14] Delavan,[16] Luc,[17] and Bellows.[18] There were in all twenty-one cases.

There was no microscopical examination in 7 cases, viz: Those reported by Dumesnil, Verneuil, Seiler, Panas, Guyon, Vanderpoel, and Burckhardt. In 5 cases the growths contain myxomatous tissue and are not therefore pure angiomata. These cases were reported, 2 by Wagner, 2 by Luc, and 1 by Delavan. Three cases, those of Richet, Huguier, and 1 of Nelaton's reported by Beuf, were probably fibromata rather than angiomata. We have then left the cases of Richet (reported by Bazy), Roe, Jarvis, Steinbrügge, and Nelaton's other case.

Roe's case was, by microscopical examination, an angioma, but it subsequently degenerated into an angio-sarcoma. Nelaton and Richet's pathological description is not characteristic enough to class their tumors among the angiomata, while in the case of Jarvis no pathological description, but only the diagnosis was given by the microscopist. Steinbrügge's case was evidently an hypertrophy. Bellows's case was, by the microscopical examination, a pure angioma.

As a further proof of the rarity of this affection, I would say that in an examination of 7,429 cases in the Massachusetts General Hospital records I have found no other case.

With regard to the symptoms the only two of importance are hæmorrhage from and occlusion of one nostril. In all the reported cases a mere examination of the growth with probe or finger caused extensive hæmorrhage.

As regards prognosis it is evident from Roe's case that a pure angioma may degenerate into a malignant growth.

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[1] Annal. des Mal. de l'Oreille, Vol. I, p. 169.
[2] Diseases of the Nose, N. Y., 1884, pp. 149, 150.
[3] Zeit. für Ohrenheilkunde, Vol. VIII, p. 110.
[4] American Specialist, Phila., 1881, Vol. II, p. 7.
[5] Cited by Débrie, Thèse de Paris, No. 5, 1882.
[6] Trans. of the Amer. Laryngological Assn., 1885, p. 94.
[7] International Journal of Antiseptics, Vol. I, p. 1.
[8] Cited by Jarvis, *loc. cit.*
[9] Bericht über die Chirurgische Abtheilung des Ludwigs-Spitals, Charlottenhilfe (1884), 1885, II.
[10] Cited by Beuf, Thèse de Paris, No. 69, 1857, pp. 21, 25.
[11] Bull. de la Soc. de Chir. de Paris, 2e s., I, p. 7; Séance of January 4, 1860.
[12] Bull. de la Soc. Anat. de Paris, 1872, Vol. XLVII, p. 435.
[13] Bull. de la Soc. de Chir. de Paris, 3e s., Vol. II, p. 356; Séance of June 25, 1873.
[14] Ibid., p. 339, Séance June 18, 1873.
[15] Cited by Débrie, op. cit.
[16] Arch. of Laryngology, Vol. III, p. 174.
[17] Myxome Télangiectasique, France Médical, Paris, 1890, XXXVIII, pp. 723, 725.
[18] Ophthalmology, Otology, and Laryngology, October, 1892, p. 330.

The diagnosis of pure angiomata can only be made by careful microscopical examination. In the treatment of these growths we are met with less difficulty since all the recent authors seem to consider the snare, if used slowly, as the safest instrument. The length of time to be consumed in removal should depend upon the thickness of the pedicle. In Roe's case three hours were consumed in removal of the growth, the hæmorrhage being very slight. Jarvis and Luc got no hæmorrhage with slow snaring, but considerable from more rapid use of the instrument. The former used his own snare and écraseur, the latter the galvano-cautery wire. In my own case I attribute the slight hæmorrhage to the thickness of the pedicle.

DISCUSSION.

Dr. John N. Mackenzie, Baltimore. I thoroughly agree with what Dr. Cobb has said in regard to the rarity of these tumors. They seem to me to be extremely uncommon. In my experience I have only seen one case of true cavernous angioma: that was a case which occurred last year at my clinic, at the Johns Hopkins Hospital. It was operated upon by one of my assistants with the snare, and considerable hæmorrhage followed. It is singular, but comparatively few of our anatomists are intimately acquainted with the structure of the nasal mucous membrane, that is to say, its cavernous structure; in a great many works on anatomy it is entirely overlooked. In the transition stage of simple inflammation to hypertrophy men have mistaken the large network of cavernous spaces for cavernous angioma and I think a number of the cases in literature are none other than portions of the hypertrophied membrane in the stage which represents the transition period from simple inflammation to the hypertrophic stage. There is one condition, too, that may be mistaken for true angioma, a condition I described some years ago before the Laryngological Association, namely, a pendulous prolapsed condition of the turbinated bodies. The turbinated body sometimes assumes a pendulous form and may even hang out from the exterior of the vestibule, presenting all the appearance of a true angioma, and that might very readily be mistaken for an angiomatous tumor.

Dr. F. C. Cobb, Boston. I agree with what Dr. Mackenzie has said, but in this individual case the tumor grew from the wall of the septum itself and contained no glands or any other signs of hypertrophy; the pedicle was very thin and small.

AN INTERESTING CASE OF MYXO-SARCOMA, WITH GENERAL SARCOMATOUS INFILTRATION.

By CHARLES S. RICHARDSON, M. D.

During the early part of October, 1892, there came under my observation a child, 5 years of age, presenting quite an interesting clinical history. This child had previously been under the care of Dr. Bayne, who referred him to me. The patient was born to parents of unusually good health and free from any hereditary physical defects or vice. The child was strong and apparently in perfect health until the end of his second year. At this time his parents noticed that he sniffled and that his nasal breathing was somewhat impaired. This difficult nasal breathing became slowly but progressively worse, and was followed by a train of symptoms due to imperfect nasal respiration. He became restless at night; snored and caught his breath; would wake up crying, as though frightened; would breathe with his mouth open; and on awakening in the morning would be cross and irritable. About six months before coming under my care the parents

noticed that his voice was muffled and had lost nearly all its nasal quality. The child now began to lose flesh, showing but a slight desire for food. A growth now developed upon right side of neck, and it was also observed that something was protruding from the left nasal cavity. Discharge from nasal cavity was thin and watery, never sanious, nor was there ever any free bleeding. Shortly before consulting Dr. Bayne dysphagia was added to the child's already pitiable condition. At this time the inability to ingest food was confined to solids, liquids being taken with some degree of ease. Dr. Bayne removed the mass protruding from the nose, and then referred the parents to me.

On presentation he was noted to be a well-formed boy of average height; body and face extremely emaciated; nasal breathing entirely annulled; oral breathing distressingly loud and unpleasant. He was very weak; voice almost absent and unintelligible; was drowsy, and if held quiet for a few moments passed into a deep sleep. Externally his nose was well formed and showed no deformity. On the right side of neck there was a tumor of about 3 centimetres in diameter. The mother stated that for about three days the child had found it almost impossible to ingest food, either liquid or solid, and she feared that he would starve if something were not done immediately. I found her statement to be absolutely correct, as the child could not swallow water when offered. Both nasal cavities were filled with a grayish white mass which protruded slightly. The mouth was in a horribly offensive condition; the lips were fissured and covered with dry crusts and the teeth with sordes. The tongue was dry, horny, and deeply congested along its free borders. The hard palate was covered with dark brown deposit and the soft palate pushed forward until the uvula rested on the center of the dorsum of the tongue. The whole pharynx was filled up with a dirty grayish white mass that extended to the larynx below and pushed forward the soft palate until it extended well into the mouth. This mass was more or less lobulated and its lower borders were hornified. I appointed the next day for operation.

Suspecting that the growth was malignant, I prepared for considerable hæmorrhage. I operated without the use of an anæsthetic. Dr. Balloch assisted me. I removed the mass from the nose, first with the cold snare, attended with only moderate bleeding. The pharynx was cleared with the finger and post-nasal forceps. The hæmorrhage from the whole operation was much less than ordinarily attends the removal of post-adenoid hypertrophies.

The child was greatly improved by the operation and gained strength and flesh very rapidly. On the fourth day after the operation I observed a large mass of mottled grayish black tissue in the left nasal cavity, which I removed with the snare. This mass was slightly necrotic, and I supposed it was a piece that I detached and failed to remove during my first operation. Four days later, on the child reporting, I found the cavity again filled out with a mass similar to the one removed at the previous sitting. This mass was about 3 centimetres long by about 1 centimetre in diameter; softer and more pultaceous than the first tissue removed. Bleeding was also more active. I was now firmly convinced that the growth was a myxo-sarcoma. In four days there was a greater reproduction, extending even into the pharynx. On this day Dr. Balloch confirmed my diagnosis by telling me that the tissue originally removed was from a myxo-sarcoma. I now consulted with Dr. Bayne as to the advisability of doing a more formidable operation. The excision of the superior maxilla met with his approval and the day was appointed for its removal. The child's condition on the day of the operation, although only six days since my last interference, was quite as bad as previous to any operative interference whatever. The attachment of this growth seemed to be about midway of the under surface of the middle turbinated bone. With the assistance of Drs. Bayne, Van Rennselear, and Luce, I did Billroth's operation for resection of the superior maxilla. Chloroform was administered. An incision

was made from the root of the nose, extending in the median line to its top through the soft tissues and into the nasal cavity, upon the side to be operated upon. From the root of the nose an incision was carried outward to the malar prominence. In making this latter incision care was taken in carrying the knife along the margin of the orbit to avoid the infra-orbital foramen from fear of dividing the artery issuing from this canal and thereby cause troublesome hæmorrhage. An incision parallel to the second incision was carried from the ala of the left nasal cavity to the border of the masseter muscle. The nasal bones were now disarticulated and the flap containing the left nasal bone was rapidly separated from the left maxilla and thrown outward. Bleeding vessels were taken up as divided and consequently only a very slight amount of blood was lost. The whole nasal cavity was now exposed and filling out this space was seen the same character of growth that had been so often removed. The growth was traced under the middle turbinated bone, from whence it seemed to have its origin by a broad base. The body of the superior maxilla was now separated by sawing outward, in the lines of the skin incisions, and after the mass had been separated it was pried out of its position and turned outward upon the cheek. As the growth now could be seen to involve the antrum, probably secondarily rather than primarily, I decided to remove the bony mass entirely, and therefore separated it from the pterygoid process. A part of the palate bone and the pterygoid process were torn away by the forceps. The whole cavity was now free of growth. Rough edges were curetted away and the cavity having been packed with iodoform gauze, the skin flap was brought into position and carefully united. Hæmorrhage was quite free, but to no alarming degree. The patient bore the operation well and rapidly recovered from the shock. There was no bleeding after reaction set in. The patient was in good spirits and quite hungry the next morning and had no fever. On the fourth day the iodoform dressing was removed, coming away quite clean, and new gauze introduced. On the fifth day all stitches were removed and union found to be perfect. On the seventh day the gauze was finally removed. There was no fever throughout. There was only a slight difference to be noticed in the prominence of the two sides of the face. At the end of the third week, as the child seemed to be in a perfect condition, I discontinued my visits. Five weeks later the mother requested me to see the child on account of the rapid increase in size of the tumor on the right side of the neck, and, if possible, to relieve the child from the great pain that this rapid increase in size had occasioned. The growth had now assumed enormous proportions and filled out the whole left cervical region, extending from the mastoid to the clavicle. I also noticed a smaller growth on the left side, just above the clavicle. During the following week new growths appeared in lateral walls of the pharynx and in left cervical region; there was no recurrence in nasal cavity. Four months after the operation the child died from inanition and exhaustion.

In looking over the histories of some 60 cases of nasal and naso-pharyngeal sarcomata, many of the latter no doubt having their origin in the nasal cavity, I find several that correspond in their description very much to the case above given. In these extensive growths I find that the patients were quite young, but none so young as the case herein presented. Rapid reproduction is common in sarcomatous tissue, but the rapidity of regrowth in this case was of a startling nature. To have all evidences of a growth removed in one day, and within six days thereafter to have it nearly reproduced in its original magnitude, is sufficient to excite the admiration of any pathologist. We have all been taught that hæmorrhage is quite a necessary attendant upon malignancy; especially is this stated in regard to sarcoma. It therefore appeared to me to be quite remarkable that this little one had had no trouble of this character, and that the various operative procedures were attended with so little bleeding. The micro-pathological

find was that of a most typical and exquisite myxo-sarcoma, and even here we have an interesting feature to call to your attention. As you will observe, here and there disseminated throughout this mass of tissue are single fibers of striated muscular tissue. The section which shows these muscular fibers in the most pronounced manner was obtained from a mass removed from the nasal cavity.

There are several points in connection with the operative interference that require consideration. In a case of this character where operative interference was not so immediately demanded to relieve the urgent symptoms, I think it would be wise to first ascertain the character of the growth before resorting to any instrumental interference. It seems that all interference, excepting that it be of radical character, intensifies the rapidity of growth and its malignancy. One well knowing the nature of the growth can consider, from its seat and attachment, whether it is possible to remove it in its entirety and more thoroughly by the snare, or whether it will be necessary to resort to one of the more formidable operations. Growths so extensive as the one outlined above should, if any operation is attempted, be dealt with in a most liberal manner. The reason the above case was not so treated at first was on account of the desperate condition of the child and the necessity for immediate action. A positive diagnosis could not be made out from its clinical history alone. It is also a question whether even the latter operation would have benefited this patient, as no doubt a general sarcomatous infiltration had already set in when he was first brought under my observation.

SARCOMA OF THE NASO-PHARYNX, WITH REPORT OF A CASE.

By J. E. LOGAN, M. D., of Kansas City, Mo.

J. N. T., age 44 years, a teacher by profession, consulted me in June, 1888, presenting the following history: Up to the age of 40 had always been a strong, healthy man; in the autumn of 1884 he was taken with a severe attack of typhoid fever, which lasted for many weeks, convalescence being very slow. Upon recovery, or shortly thereafter, he noticed what he termed "quite a fullness in the upper part of the throat," which was accompanied by considerable secretion of saliva and some interference in breathing, especially noticeable when in a recumbent position. This condition grew steadily worse, so much so that within a few months he was unable to breathe through the nose, could scarcely talk, and had frequent sensations of impending suffocation. He applied to a local practitioner, who examined his throat and found a tumor large enough to be easily seen, low down in the pharynx. The general health of the patient had now become greatly impaired, the discharges being very profuse and extremely offensive. The physician, not feeling himself able to cope with such a disease, and not being properly equipped to perform the necessary operation, referred the man to a surgeon in our city. As nearly as I have been able to learn by questioning the patient, this gentleman pronounced the growth a fibroid tumor. He at once removed it, and dismissed the patient, leading him to think or at least to hope himself cured. His general health did improve immediately. He breathed easily, and his appetite returned. This improvement, however, was of short duration. Very soon there was a return, and a rapid and aggravated return, of all of his former symptoms. In six weeks from the time of the operation he was utterly unable to breathe through the nostrils, the discharges were fetid, the hæmorrhages were frequent, and for the first time there was considerable pain, referable principally to the left ear. The surgeon again examined him, and found to his great surprise that the growth had returned. He now gave it a more careful examination, though not, I believe, with a microscope, and pronounced it malignant. A tonic course was

prescribed in order to build up the patient's general health before venturing upon a second operation; but the tumor grew with such rapidity that he was forced to remove it while the man was still in a very weakened condition. During all this time there were no glandular complications and comparatively little pain. The second growth was removed by means of a wire écraseur, and the patient reports the operation as very bloody, though I am inclined to think that a very little blood would impress him greatly. He rallied from this second operation very slowly, but for five months he enjoyed comparative immunity from his trouble.

At the expiration of this period the old symptoms reäppeared, but in a modified form. The discharges were profuse and offensive, but the difficulty in breathing was not so marked. Profiting by past experience, he lost no time in having the new growth removed; but his promptness availed him little. The tumor again appeared in a few weeks and another operation became necessary. This went on until he had submitted to nine such operations. The frequency of these discouraged him greatly, and he finally concluded to seek the aid of a throat specialist. He applied to my friend, Dr. Schauffler, for advice in the selection of a physician, and Dr. Schauffler brought him to me for treatment. Examination of the case revealed the presence of a tumor perhaps twice as large as a partridge egg, situated for the most part upon the roof of the pharynx, with attachments along the post-pharyngeal wall for the distance of one-quarter to half an inch. Digital examination provoked profuse hæmorrhage. The tumor appeared slightly lobulated and was firmly attached to a large base. The patient's general health was much much below par. He was somewhat cachectic and was suffering considerable pain in the left ear and in the back of the head. Profiting by the experience of the other operator, I concluded to remove the tumor by another method. Tying back the soft palate, I applied a 10 per cent solution of cocaine to the growth and the surrounding tissue until complete anæsthesia was established. My first step in the operation was to cut the tumor into three sections with galvano-cautery knife, continuing the cautery from the surface to the base. My object in so doing was to cut off the blood supply as much as possible. I next insinuated a curved, flat knife under one section and removed it without much difficulty. Very little hæmorrhage attended this operation. I applied persulphate of iron to the cauterized base and sent the patient back to the hospital. I saw him each day, but applied no treatment except a warm spray of Dobell's solution. A week from the day I first operated he came back to my office, and I proceeded to remove the remainder of the growth. Upon examination I found this had been much reduced; in fact but one section of it remained, the other having sloughed away and been expectorated by the patient. The remaining portion was hanging by a few attachments to the base. I introduced my curved knife as before and easily severed the growth. The hæmorrhage was hardly perceptible. I continued to keep the patient in the hospital for a few days, using no application save the warm Dobell spray. At the end of two weeks the surface had completely healed; so perfectly healed that scarcely any induration could be detected by digital examination. I had the growth examined by several most competent pathologists, and all agreed in pronouncing it a round-cell sarcoma. The patient immediately began to improve in health under the administration of tonics and outdoor exercise, and is living to-day, as fine a specimen of manhood as one would care to see. Repeated examinations have failed to reveal the slightest evidence of a return. One of my neighboring medical friends saw him just a few days since and carefully examined him, with negative results.

So far as I have been able to find in looking over the literature of this particular subject, this is about the twentieth case on record and about the second of well-defined recovery. Some are reported as recovering from the operation and continuing in good health during the period of observation, such observations

admitted by the operators to be of limited duration. Dr. Bosworth's case is one of well-known recovery, since the patient is to-day within the limits of this beautiful city, with no intimation of trouble from the disease. The case reported by Dr. Lincoln was probably one of recovery, but his period of observation was too short to enable him to say certainly that there was no return. We see enough after looking into this matter to prove that sarcoma of the naso-pharynx is a very rare disease, and in a large majority of cases is fatal. Just why a few of these cases have recovered while the others have died we can not, of course, explain. But might it not be well to observe that of all the cases operated upon those removed by the simplest means have shown the greatest tendency to recover? In writing upon this subject Dr. Bosworth says in his monograph in Wood's Medical and Surgical Monographs, Vol. XI, p. 256:

Various operations were resorted to in these cases, such as the galvano-cautery, curette, the spoon, and the cold snare manipulated through the natural passages, while some of the cases were subjected to radical operations, such as excision of the jaw, etc. There certainly seems to be something of consideration in the fact that the only successful case was cured by the use of the cold snare operated by the natural passages; and moreover that in this case the use of the galvano-cautery was attended with most unfortunate effect, indicating here also, as in the nasal cavity, that this disease is to be treated with great gentleness and any danger of injuring neighboring parts avoided.

The truth of his last proposition I think beyond question, but the opinion which Bosworth expresses of the galvano-cautery is scarcely borne out by the facts presented by my case nor by those in the one reported by Dr. Lincoln. The inflammatory reaction following my operation was inconsiderable—so slight indeed that the Eustachian tubes did not even show any signs of participation, which they would naturally have done had there been any such condition. Had the growth been of such a size as to have made necessary the application of the cautery for an indefinite period, I should probably have resorted to more rapid means; but when one is able to accurately define its outlines in the vault and can apply the galvano-cautery without danger of injury to other tissue, it seems to me to be the most simple and effective measure.

DISSCUSSION.

Dr. JOHN O. ROE, Rochester, N. Y. One case of myxo-sarcoma of the nasal cavity came under my observation about six years ago. I was requested by a physician in Cayuga, N. Y., to go there and remove a growth from the nose of an old lady. I found a lady about 65 years of age, with the nose so dilated and face so disfigured as to have a frog-shaped appearance. What annoyed her the most was the projection of so much of this tumor into the throat as to nearly choke her. I was not prepared to operate upon such a formidable growth, but with the instruments I took with me I succeeded in removing the greater portion of it. I passed a wire loop down through the nostril along one side of the growth, brought it out of the mouth, and passed it up along the other side of the growth. Then, with the finger in the mouth, I engaged the greater portion of the mass in the loop and removed it. The amount removed nearly filled an ounce quinine bottle. I did not remove the whole of it, however, as the base was attached to the ethmoid and the middle turbinated bones, but the patient was very much relieved by this operation. As she was much reduced in strength and quite anæmic, we built her up as best we could, so that in a few weeks she was able to come to Rochester, when I proceeded to remove the base of the growth as thoroughly as possible. She stood the operation very well, but in a few days she sank and died from asthenia. The

portion I removed first showed it to be a myxoma; but the latter portion that I removed, the base, showed it to be a sarcoma, so that very likely it started with the outer portion a myxoma and the base a sarcoma.

Dr. E. Fletcher Ingals, Chicago. I am interested in this matter, having seen a number of cases of malignant growth of the nose, though I can not now state whether they were sarcomas or epitheliomas. I now recall four cases. One, in a lad twelve or thirteen years old, was shown by careful microscopical examination to be a mixed sarcoma, and partially fibrous, but with enough of it of the sarcomatous element to ensure its malignancy. In that case the reaction following the use of the galvano-cautery increased the rapidity of growth, and I obtained much better results from operations with the knife, snare, or forceps. The growth was carefully removed two or three times, and the boy lived for at least two years how much longer I do not know, as he passed from my observation. I once saw such a tumor in a gentleman of advanced age, where the nose was so full, the patient so debilitated, and his age so great that I could not conscientiously advise any operation. He lived but a short time. In another case upon which I operated two or three times with the snare and cautery, the patient was considerably relieved and lived for five or six months. I saw such a tumor recently in a gentleman 63 years of age. The right nasal cavity was distended by the growth, there was abnormal prominence of the right cheek, and considerable protrusion of the right eyeball. The patient suffered greatly from pain through the right side of the head. Some part of this growth, which had been termed a polypus, had been removed a little while before. He and his family were very anxious to have another operation. Believing that extensive operations for malignant growths in this locality in aged people are seldom justifiable, I did not decide upon a surgical procedure until after consultation with Dr. Senn and weighing all the circumstances in the patient's history. Removal of the superior maxilla was considered inadvisable in a man of his age, so I decided to remove the growth by the cold wire snare and a sharp spoon. The patient was given ether and the cold wire snare introduced in a manner I thought likely to remove the attachments of the tumor without causing much bleeding. I was unable to ascertain the exact attachments of the tumor before operating, therefore I passed a special canula through the upper and outer part of the nasal cavity, keeping it as far to the right as possible, and brought it into the naso-pharynx. Through this I passed a small catheter, the end of which was caught by forceps and brought out of the mouth; through this I passed one end of a steel wire 3 to 4 feet long, bringing it out through the nostril. Another catheter was passed in beside the lower outer part of growth and the other end of the steel wire was pushed through this until it came out of the nose. The ends of the wire projecting from the nose were then drawn upon and at the same time the catheters were removed and the loop drawn in through the mouth up to the outer side of the tumor, as the upper part of the tumor was likely to be adherent. Another catheter was passed through the canula, through which I had returned the end of the first wire; the end of the catheter was brought out of the mouth and the end of a second long wire passed through it and out of the nose. Another catheter was then introduced and brought out the mouth as high up as possible on the left of the tumor and through it the other end of the second wire was passed; the catheters were then withdrawn, the wires pulled out, and the loop passed in at the mouth and inclosed the upper attachment of the tumor.

I put a snare on each of the wires and cut off the growth, which proved softer than I had anticipated. There was practically no bleeding. My reason for using the snares was that I expected much bleeding when the growth was attacked and felt that if I could get out the major part of it without much loss of blood I could then curette rapidly and pack the nose to stop the hæmorrhage. I pulled out the

piece which had been separated with the forceps and then scooped out the remainder of the growth rapidly with a sharp spoon. There was but little hæmorrhage. The patient was a large man, which made it easy after the removal of part of the growth to introduce my little finger into the nasal cavity. I could feel the granular surface of the malignant tissue, and I scraped it out until the walls of the antrum and the vault of the nasal cavity were perfectly smooth. The floor of the orbit having been absorbed I could feel the under surface of the eyeball, separated from my finger only by a granular tissue which could not easily be scraped away and was finally concluded to be adipose tissue. The tumor seemed to have been as thoroughly removed as it could have been if I had removed the superior maxilla. The next morning the temperature ran up to 103°, and for seven or eight days the patient complained of pain in the eye, which was much swollen. A large diffused induration just back of the angle of the jaw was also swollen during this time. About the eighth day the fever went down, the swelling subsided, the pulse became nearly natural, and the patient became comfortable; but before another day had passed he had a chill, the temperature rose to about 104°, and twenty-four hours later he became paralyzed on one side; an extravasation of blood into the brain had occurred, from which he died three or four days later.

Dr. C. W. Richardson, Washington. The consensus of opinion seems to be in favor of the milder operations. Of course, when they are attended with the best results in a nasal case such should be the course to pursue, and such would be the course I would pursue in many of these cases if the growth was small and did not infiltrate neighboring tissues, but as the general surgeon deals with sarcomatous infiltration in other portions of the body in the most liberal manner, so it seems to me that in many of these cases of sarcomatous infiltrations of the nose and pharyngeal cavities that have resulted fatally, when the growth was small if they had been dealt with in a more liberal manner and the growth removed in its entirety they would probably have resulted differently. In the case I reported I do not think anything was to be done except in the most generous manner. The case was a good one for such operation if there had not been the probability of secondary infiltration. It had already involved the antrum and the posterior portion of the antral cavity. To have attempted to remove this with snares would have been useless, as five or six operations previous to removing the maxilla proved. Of course in a case of that kind where the patient is in such an emaciated condition, and in fact demanding interference to save the life if possible, the particular operation I did was the one that should be done. The rapid reproduction of the case was something very startling. Within four days after the removal of the tissue, both with snare and forceps, the patient returned and I found a great mass filling out the left nasal cavity. I could hardly believe it was a reproduction until after I had got my snare on it and tore it away. When I removed it the posterior portion was somewhat necrotic; that was evidently where the growth had formerly been removed, and tissue above it had been pushed down as reproduced. There was reproduction again in four days, which was very remarkable, and each time the growth was removed the tissue was of a more malignant character. I did not refer very much to the gland that was situated on the right side; the growth was on the left. When I operated upon the case the patient seemed to be in a pretty fair condition, and I was in favor of removing that gland, or rather the tumor, but the gentleman who was with me in the case seemed to think it was an enlarged gland. Within three months that growth had assumed enormous proportions. Dr. Bayne saw the case before me and thought he detected fluctuation, and opened it, thinking it was an abscess. I removed some of the tissue from this opening and found it to be sarcomatous. Before the child died the whole left side was filled out the same as on the right and the condition was one of the most marked general sarcomatous infiltration that I had ever seen.

Dr. JAMES E. LOGAN, Kansas City, Mo. About three years ago I had sent to me a case of sarcoma of the nasal cavity, which was so complicated that the patient was completely depressed and very anæmic. The sarcomatous infiltration extended into the eyeball socket and upper eyelid, so much so that the lid was thickened and protruded out from the man's face. From my previous experience in operations upon the superior maxillary, I decided to remove this growth, which I found situated upon the turbinated bone, filling almost the entire antrum, with the galvano-cautery by piecemeal, if I could get the patient to live long enough. I was satisfied the infiltration was so great the patient would die anyway. I removed about one-third of this growth. This patient while in the army had received a chest wound in the right side just above the nipple. He began to sink rapidly after the operation and died from hæmorrhage from the lungs. I made an autopsy and found that this sarcomatous infiltration had gone to the seat of the wound he received some thirty years previously, and from that center had extended over the whole lung surface. As regards the use of the galvano-cautery in these cases, so far as I have been able to see, operative procedures of a severe type have never been followed by evidences of even partial recovery, and in these cases the only operative procedure I would recommend would be a partial removal, at repeated sittings. I do not think anything other than the galvano-cautery or the cold snare should be used under any circumstances; that the results in these cases do not warrant a more thorough operation.

DISCUSSION ON TREATMENT OF HAY FEVER.

Dr. D. BRYSON DELAVAN, New York City. No greater task could be imposed upon one than to open a discussion upon the subject of hay fever. It is desirable, however, to obtain the sense of this meeting on the treatment of hay fever, and I hope that the discussion will be strictly confined to this department. There are two conflicting opinions regarding hay fever. One is that it is essentially a local condition; on the other hand, it is held by a far greater number that however much local influence may have to do with its production there is, broadly speaking, in the majority of cases at least, an underlying condition of some sort which tends to the production of this disease. Accepting the latter view, it is necessary that the treatment should be conducted in accordance with it. If it is conceded that there are general causes underlying hay fever, then reliance can not be entirely placed upon the treatment of local conditions. The general as well as the local state of the patient must be attended to. It is necessary therefore, in order to treat hay fever successfully, to look into the general well being of the patient and find whether he is suffering from lithemia, malaria, or any serious disorder of the heart, lungs, or kidneys, and to investigate the condition of his digestive tract. These, or any other general or diathetic states which could contribute to the local trouble, must, as far as possible, be improved.

The local treatment of hay fever may be broadly summed up under two distinct heads. Under the first plan are used various heroic therapeutic and surgical measures. Under the second are employed general therapeutic measures which are not heroic, the chief object of which is to subdue local irritation, and there are also surgical means which have exactly this same end in view. I believe that where conditions exist in the nose which contribute directly to the irritation of the nasal passages, such for instance as distinct organic occlusion of the nose, then surgical means may be of great use. On the other hand, nasal surgery in this department has often been carried too far. It is extremely unwise to interfere in a case in which we can discover no good cause for interference, simply because the patient desires to be cauterized or to have a spicula of bone removed which

he supposes is there. Where there is not present a condition which distinctly calls for surgical interference it is wrong to advise the removal of apparent obstructions, and to practice the use of the galvano-cautery as often applied to the nasal mucous membrane in such cases. It may be unnecessary to state here that wholesale destruction of the nasal mucous membrane is not a good means of curing the disease, yet there are some who, in a case of hay fever, will destroy it far and wide, by means of caustics or the galvano-cautery.

With regard to the use of cocaine; every good thing seems to have its negative side. Thus, the most valuable of drugs, opium for instance, may become the most dangerous; and so it is with cocaine. This drug is doubtless a great blessing to persons suffering from hay fever. Its indiscriminate use, however, in this disease is productive of serious evils; indeed, in these cases cocaine improperly used will do vastly more harm than good, and I would like to go on record as distinctly and vigorously opposing its indiscriminate use in these hyperesthetic patients.

To recapitulate: If the discussion be confined to a few of the points herewith raised we shall have enough to do. I would like to call attention especially to the question of the recognition and treatment of coëxisting conditions. I would also call attention to the abuse of surgical interference and to the proper and improper use of cocaine. The discussion should include the best means of treatment; that is, the means which are the most practical, the least theoretical, and most successful. The discussion seems opportune here in view of the fact that this meeting represents such a wide diversity both of territory, experience, and thought.

Dr. Price-Brown, Toronto. I suppose I am particularly qualified to speak on hay fever, as I have been subject to it for the last ten years. I do not know in my personal history that I have suffered organically any other way; I do not know that my system has been deteriorated; I do not know that my kidneys, or lungs, or organs generally have been at all out of order, but I know that periodically, about the middle of August, I have an attack of this disease. I may say, however, that before I ever had hay fever, frequently with the slightest cold I suffered from closure of the nasal passages to a certain extent. I would find the greatest difficulty in breathing through the nose in cold weather, and this finally developed into an attack of hay fever. For two or three years I did nothing special for it; then I used a little cocaine; but four years ago the attack I had was most intense. I remember that it did not seem as if I had the power of thinking or feeling anything, except the intense sensibility produced by the disease, and I determined to operate upon myself, if I could find the part of the nasal cavity where the thing originated. I felt the indications in the back part of the left naris. After sneezing about one hundred times I sprayed the left naris with a 10 per cent solution of cocaine, and passed a probe into the passage. I found at the back end of what I assumed was the inferior turbinated bone a sensitive spot, with another about the middle of the passage. I then passed the cautery blade to the posterior spot and turned on the electricity and singed it; then to the next spot and singed that. The result was that for the rest of that year my paroxysms of hay fever were not so severe. The following year the trouble commenced in the back of the right nostril, and when most intense I operated in the same way. I might say in passing, that I have had many cases of hay fever under treatment at different times; and one of the prominent symptoms has been exceeding irritation of the palate, particularly the uvula, the patient desiring to scratch the uvula and rub his tongue over it. The result is there is great elongation of this organ. The following year I amputated half of my uvula, which resulted in great benefit. Last year my attack of hay fever was not very severe. This year it has been less than ever, and I have had no operation. It came on about the 24th, instead of the 14th, and I had no hay fever of any account until I started from Toronto, but on

my first night in the hot, dusty car coming south the attack became intense. I got alumnol the moment I heard of it. The treatment I generally use is a light solution of cocaine, giving it myself. I use the cocaine first, and afterwards menthol in albolene. It seems to me the action of menthol in from 5 to 10 or even 20 grains to the ounce has the effect of lengthening the action of the cocaine. Latterly I use menthol more than I do anything else in my cases; this year I personally used no cocaine whatever. I find it more beneficial to apply the menthol to the throat, and have the patient breathe in through the mouth and out through the nose. In regard to any occlusion producing hay fever, I mentioned a case this morning where the columnar cartilage pressing against the wall of the nostril caused hay fever, and the removal of that cartilage removed the hay fever. From the effect that alumnol has had upon me to-day I think it will prove a good thing, and I shall try it in future.

Dr. JOHN O. ROE, Rochester, N. Y. In every case of hay fever there is more or less disease of the nasal mucous membrane, and the more I see of hay fever the more I am convinced of the correctness of this assertion. I have yet to see a patient in whom disease of some portion of the nasal mucous membrane does not exist, and when I hear a case reported in which the patient suffered intensely from hay fever but without any local disease in the nose I think that the doctor is in error and did not discover the local lesion, perhaps on account of making only a cursory examination. When we consider that the nasal mucous membrane in adults covers a region of about 26 square inches it is not surprising that disease may lurk in some portions and remain there undiscovered unless a most thorough examination is made. Hay fever may be considered a neurosis (pardon me for an allusion to the neurotic theory), but we have a great many neurotic people who do not have hay fever, and there are a great many people who have a great deal of disease in the nose who do not have hay fever; but when a person who is intensely neurotic has a great deal of trouble with his nose he is quite sure to have hay fever. There are a great many, as in Dr. Brown's own case, who have fever when there is apparently no neurotic element, and in such cases the disease is, I believe, as much a local disease as any disease can well be. Disease in the nose that may be the seat of the irritation is not necessarily confined to any one region, as it has been believed to be confined to the region of the inferior turbinated bodies, either the anterior or posterior end. The part that I have found to be most sensitive in these cases is the nasal septum, and this undue sensitiveness has been usually excited by an intermittent or constant pressure of the turbinated bodies. The exciting cause of these neurotic conditions I believe to be in nearly all cases intranasal pressure, either from intermittent or constant contact between the different portions of the interior of the nose. It is, however, not necessary for this pressure to exist between the turbinated bodies and the septum, for it may exist between the turbinated bodies themselves or the inferior turbinated body and the floor of the nose. In the latter instances the extreme sensitiveness is confined to these bodies.

The galvano-cautery in the treatment of these cases is frequently the most serviceable agent we have, but there are many conditions of the nose in which its use is not advisable. It is useful in vascular turgescence, but can not be employed to advantage in firm hypertrophy or osseous excrescences. It is usually not advisable to institute treatment during the attack, although in some instances the abnormal conditions in the nose are emphasized during the attack and should be attended to at that time.

The beneficial effect of local treatment can not be better illustrated than by the case of a young lady whom I treated last summer one year ago. She was about twenty-three years of age, distinctly neurotic and neurasthenic, and her mother was also neurotic. She had suffered from hay fever severely for seven years, and was willing to have anything and everything done that would relieve her of this distress-

ing complaint. As it was so near the time of her attack I advised her to have the nostril in which she had the most difficulty treated, as she was unable to go through the necessary treatment for the removal of the difficulty from both sides at the same time. There was pressure of both the inferior and middle turbinated bodies against the septum. This I relieved and carefully treated the nose. The result was that she passed through the summer without any trouble in this her left nostril, while in the right nostril, which had not been treated, she suffered from hay fever quite severely, although, the left nostril being free, respiration remained unobstructed and she did not suffer the distress experienced when both nostrils were completely blocked up. Later in the season, after the hay-fever period had passed, I treated the other side carefully, and she has passed through the hay-fever season this year without any disturbance from hay fever.

In all cases of hay fever, more or less constitutional treatment is advisable, as the local disturbance has a marked effect in lowering the tone of the system, independently of the neurotic trouble with which it is frequently associated. The tonics proposed by Dr. Mackenzie are excellent and I have found them of great service. One thing that is of importance is nutriment to build up the system, and one of the best nutriments I have found to be eggs. By breaking an egg into a glass and having the patient swallow it whole he will take from five to ten eggs, or even twenty, a day. Many patients will be very much improved and their attacks somewhat modified by increasing the resistance of the system to local irritation, or frequently by the employment of a sedative that will abolish to a great degree the response of the nervous system to the local irritation, but in addition to this there is in all cases some localized disease, which should be found and carefully treated. Therefore, however much you treat the person generally and build up his nervous system, or however much you may improve the condition of the vascular system, you must attend to the local condition in the nose, be it ever so severe or ever so slight, if you wish to relieve your patient positively and permanently from hay fever.

Dr. S. S. Koser, Williamsport, Pa. I am glad to note on the part of this section the deprecation of the free and undue use of cocaine. It was only a week ago that a pharmacist of my city mentioned to me that he had regularly several customers for cocaine, and added that he was quite sure that the habit was first contracted in all of them from using the tablet at home, that the market is now flooded with, for these nasal cases. I believe the position taken this afternoon in the matter of prescribing cocaine, not permitting the patient to use it at home, is wise. It is a terrible thing to be the means of establishing cocaine inebriety in any case. In connection with this discussion I wish to call attention to a couple of articles that have done me good service as temporizing agents in mitigating the severity of hay fever. One is terebene. I have certainly found it quite valuable as a mitigating agent. I would also like to call attention to an old remedy, but one that has not been referred to in this discussion, and that is the inhalation of a strong solution of carbolic acid, camphor, and chloroform, in the proportion of about a dram of the crystals of the acid and 1½ drams of the camphor to 2 or 3 drams of chloroform, used in a smelling bottle. In fact, these cases come to us at such a stage that I rather prefer to palliate them first. I do not believe it is good surgery to rush into an operation on the nose when the engorgement is so great. That is, I do not believe proper conditions exist for good surgical repair. I would rather say it is good practice to first palliate the case and watch for one of those opportunities which the gentleman from Toronto (Dr. Price-Brown) referred to as the conditions present prior to developing hay-fever symptoms, and to operate on the turbinates at some time other than during that attack. Preëminently, in my experience, the operation that does the most good and which is more permanent is to gently clip the lower ends of the turbinated bone. This, in my hands,

yields the most lasting benefit, and I have frequently preceded an operation with the use of the cautery, so that there might be less tendency to hæmorrhage following the operation itself. The point, then, I wish to make is that in my experience I have had better results in operative procedures if I deferred the operation until the intervals of the attack. I believe, then, that the permanent results are better, the parts will heal kindlier, and in all respects will do our patient a greater good.

Dr. JAMES E. LOGAN, Kansas City, Mo. I wish to confirm Dr. Roe's experience in hay fever. Living in a country where hay fever is prevalent, I have seen a great many cases, but I have yet to see a case uncomplicated with hypertrophic rhinitis or rhinitis in some form. I read an article before one of our medical societies in 1886 in which I made the statement that I did not believe hay fever could exist without a previously existing rhinitis of some form, and after years of experience I am willing to support that statement to a considerable extent, for I have never seen a case where there has not been some such trouble, either from a deflected septum, exostosis, hypertrophic rhinitis, or some disease where there was a soil in which this idiosyncrasy was produced.

The treatment I have used for the last few years has been the cautery. I begin the cauterizations about a week previous to the first attack and continue them at intervals through the period of hay fever, and by continuing these cauterizations after the period has passed, relieving whatever condition, mechanical or otherwise, that existed there, and in succeeding year continuing a mild course of cauterization through the period of hay fever, I have relieved quite a number. I have recorded some cases of very pronounced recovery in this respect.

A lawyer who has an office next to mine, who was a constant sufferer for sixteen years, suffering the tortures of death almost from hay fever, and who had travelled the world over seeking relief, is a standing monument of the efficacy of the treatment of hay fever as I have suggested it. To-day he has no trouble whatever from it, and there are a number of cases of a similar nature. The neurotic tendency, which I believe exists in nearly every one of these cases, whether it be perceptible to the physician or the patient, is a latent element which must be corrected by medicinal means preceding the hay fever period. Beginning a week previous to the attack, I administer a preparation of nitrate of sodium with a half grain of camphor, continuing that six weeks after the attack has passed; I have found it to be an admirable sedative, and can heartily recommend it. My mother was a great sufferer from hay fever and asthma, and in 1885 I removed from her right nostril a large tumor, after which she had no trouble from hay fever or asthma until two years ago, when I found there was considerable hypertrophy existing in the left nostril, also in the right, together with a deflected septum, that by reason of my position in the family I had to refuse to operate on. About six weeks ago I removed an exostosis of considerable extent, and she writes me she had had no hay fever this season so far, and no asthma. I think there is great progress yet to be made and many things to be found out in the treatment of hay fever.

Dr. F. C. COBB, Boston. I would like to know whether in hay fever the writer includes vaso-motor or hyperæsthetic rhinitis? I have had some cases of that kind, and although in a good many of them I could not find any very marked nasal-obstruction, yet cauterization, not of a very wide area, but usually over the lower turbinated and points opposite to it on the septum, which seemed to be especially hyperæsthetic, appeared to give great relief, and a year later I heard from these cases that they had had very little, if any, hay fever. But those cases which were complicated with asthma still had asthma; there was very little relief from that. These were hospital cases operated upon year before last and they all had a great deal of trouble; some were complicated with polypi, which, of course, were removed. But all to whom I wrote reported very little nasal trouble, so I believe that cauterization, at least to a limited extent, is of considerable value.

Dr. J. H. Bryan, Washington, D. C. I think there must be two conditions or else we would not have such diametrically opposite ideas, one of which is due to a morbid condition of the nose, which of course is relievable, but those cases in which in the interval of attacks there is no morbid condition I do not believe can be cured by local treatment, yet the symptoms can be greatly palliated. I think in this locality we have as much hay fever as anywhere in the country and I have seen quite a number of cases. Those which have been dependent upon exostosis or pressure of the turbinated bodies have been easily relieved and have not returned, but those which are entirely neurotic in character, where in the interval of the hay fever attacks, as far as observation goes, it is impossible to see any morbid condition invariably return, in this part of the country, about the 15th of August. I can not understand why there should be a discrepancy of opinion. Dr. Roe and Dr. Logan are positive the condition is not due to anything but intranasal disturbance, but I have two cases in which I think it is impossible to find anything existing in the nose in the interval of the attacks.

Dr. E. Fletcher Ingals, Chicago. I did not intend to say anything upon this subject, but I am so heartily in accord with the last speaker that I wish to amplify and support what he has said. I have thought for a long time that where there is nothing discoverable in the nose during the interval, treatment of the nasal cavities is useless. Where there is something discoverable that gives the patient discomfort, treatment of the nasal cavities may be valuable. I have seen several cases where there was no hypertrophy or other form of obstruction, in which there was hyperæsthesia, and in these cauterization has been beneficial. As to the time of cauterization, my plan is to complete it at least two or three weeks before the attack is expected, so as to allow the mucous membrane to become healed before the ontset of the disease. The cauterizations are rarely made oftener than once in five days, and cover an area of not more than a centimeter in diameter. The burn is superficial, never destroying the mucous membrane. Such cauterization has an effect similar to that of a blister on the skin, and after the treatment it is impossible to find cicatricial tissue. In some cases where there is much swelling, deeper linear cauterizations are necessary. I do not favor removal of the turbinated bodies in the way suggested by one of the speakers, believing that it is not best to destroy so much of the mucous membrane. If I wished to remove the turbinated bone I would run a trephine or burr through it, beneath the mucous membrane, thus removing enough of the bone so the soft tissue would fall to the side and be out of the way.

I have seen one case in which daily soothing treatment alone, carried out by the patient for a period of two years, prevented recurrence of the attacks. I have seen one case in which no topical or general treatment was employed, in which the patient, when the attack came on, by force of will never sneezed if he could possibly avoid it and persistently refrained from blowing or wiping the nose. As a result of this course he had only a slight attack the first year it was tried, and the next year practically none. I hope some of the other gentlemen will tell us what can be done by general treatment. It seems to me that half of the cases can be relieved, perhaps cured, by local treatment during the interim; but if the patient comes to us after the attack has been established local treatment is not important excepting to soothe the parts. A day or two ago a physician who has been troubled with hay fever told me that he has a rheumatic diathesis for which he has recently taken a few grains of salicylate of soda, which he feels confident is preventing him from having hay fever this season. It may be that the gouty condition causes hay fever in many cases, the rheumatic condition in others, and I have no doubt that digestive disorders have much to do with it. For my own part, I rely much upon a general tonic and sedative treatment similar to that recommended by the late Morell Mackenzie, consisting of the phos-

phate of brucia combined with camphor, hyoscamus, salol, and sometimes with valerianate of quinine. I have used this treatment for two or three years, I think with much advantage. I begin the treatment three or four weeks before the attack is expected, and have the patient continue it throughout the season.

Dr. JOHN N. MACKENZIE, Baltimore. I have been very much interested in the discussion and I am very much pleased that the word pollen has not occurred in the remarks made. The day is dawning when we will find a solution of this problem in the study of pathological law and not in an inquiry into the processes of plant reproduction. It is difficult to disassociate the pathology of hay fever from its treatment, because the latter depends upon what is conceived of the former. The pollen theory I regard as the greatest bar we have had to the march of therapeusis in this disease, and next to that I am afraid we are having another barrier set up in the too exclusive theory of the nasal nature of the malady. If we view it from the higher vantage ground of general pathology and laws of health we may catch a very much broader glimpse of the protean aspects of the problem and be in a much better position to relieve our patients than if we follow the beaten track of the pollen theorists. I certainly see cases in which there is no respiratory lesion whatever during the interval between the attacks. When I first began to investigate this matter I was allured by the new theories concerning the disease and for a long time was completely under their dominion, but further examination and broader conceptions of the disease have taught me the lesson that in a goodly proportion of the cases there is no appreciable local respiratory lesion whatever. Another point: It is not in the nose alone that these lesions are found: the area in which the nerve storm breaks will depend upon the seat of the local pathological process. For example, take a neurasthenic with a polypus in the rectum, the nervous disturbance produced by the polypus would be referred to the lower bowel, whereas in the case of a polypus in the nose the impressions would be referred to the upper respiratory tract. These lesions, when they do exist, as they undoubtedly do, may exist in the nose, pharynx, retro-pharynx, larynx, bronchial tubes, and trachea even. The point I wish to make is that the nose alone is not the only part of the respiratory tract that is responsible for the outbreaks of the disease falsely called hay fever. A great deal has been said in recent years about pressure irritation, but it seems to me that instead of producing hypertrophy it is more likely to produce atrophy. Take as an illustration cases to which the middle turbinated bone is enormously developed: as it gets larger and larger instead of producing hypertrophy of the septum it produces atrophy, and goes through to the other side.

Dr. Cobb has brought up the question of the identity of these different forms. They are all blood relations—coryza, vas-omotor hay fever, rose cold, June cold—and if we should classify them as one disease it would simplify matters very much.

As to the plan of treatment, my rule has always been to examine the patient, going over him from head to foot, finding out any peculiarity, any disease, general or local, that might be the source of any systemic, local, or remote irritation. They are all different, like the stars, and in that way you get at a more rational plan of treatment. Having done that, I look carefully after any disease, either gross or microscopic, in the respiratory passages, not in the nose alone, but all through the tract, from the tip of the nose to the bronchial tubes. After having found the general condition I treat according to the circumstances of the case.

Dr. Ingals wishes to know about the general tonic treatment. I can not give any rule. I feed the nervous system; it is always broken down. We do not always find conspicuous nervous phenomena among hay-fever patients, but there is always a nervous organization—a screw loose somewhere in the nervous mechanism. I generally start out with a pill containing about one-sixteenth of a grain of phosphide of zinc, about 2 grains of quinine, one-fourth grain of extract of

nux vomica, to be taken before meals, and after meals 3 to 5 drops of Donovan's or Fowler's solution in water. Very frequently I have to substitute some other nerve tonic, but the main point is that the nervous system must be braced up. If there be disease of the respiratory organs, remove it if possible. If there be no apparent disease, and if upon experimental stimulation of different portions of the mucous membrane no sensitive areas are to be found, let it severely alone. But if, on the contrary, as is frequently the case, we can localize these areas I treat them by cauterization, and for this purpose the galvano-cautery transcends all other methods. We find these sensitive areas not only in the places where I have located them in the nasal passages, but also in other portions of the respiratory tract, in the posterior wall of the pharynx, in the arytenoid commissure, and the posterior wall of the trachea. Why is it that the removal of a nasal polypus, for example, will dissipate hay fever permanently? The explanation, it seems to me, is this: Take an illustrative case; the patient consults his physician, perhaps suffering from violent paroxysms of sneezing, obscure cough, and other symptoms referable to some reflex producing agency. The patient goes on unrelieved day after day. Asthma is finally added to his symptoms, and finally he blooms out into a regular hay-fever patient. If it is summer the physician tells him he has hay fever; if it is winter he is told he has asthma. At this stage of the disease a polypus is discovered and removed and the reflex symptoms are dissipated, and the patient gets well. What is the explanation of that? No attention has been paid to the central nervous apparatus; simple operative work in the nose has secured the result. In this class of cases the way in which the nervous system is influenced is through the constant irritation by the foreign body in the nose; the irritation of the nerve centers, the weariness they experience at being forever called upon to discharge their functions. With the removal of the polypus the irritation is taken away and physiological rest secured for the centers, and in that way the patient gets well. If the polypus remains unrecognized the condition goes on for years, other organs are included in the arc of reflex disturbance, changes occur in different organs which are impossible of eradication, and local treatment alone will lead to temporary relief, but will not effect a permanent cure. In regard to surgery; it is called for when surgery is necessary, and it is only necessary when there is something pathological to be removed from the respiratory apparatus.

Dr. John N. Mackenzie, Baltimore. I omitted to make an important point, and that is that hay fever does not exist only at one time of the year. I believe it is like epilepsy, with you day and night, summer and winter. One of the worst cases of hay fever I ever saw was a lady in Baltimore, whom I treated for four successive Januarys. She never had it in any other month; it was a marked case of hay fever, with asthma. My plan is not to commence with a tonic at the period of attack, but I commence from six to eight weeks, sometimes three months, before the expected attack, and I feed the nervous system for all it is worth during that time; and I not only do that but I treat the patient through the year at certain intervals, depending upon the patient, the character of the case, etc. I treat them during the entire year as if they were just on the verge of a paroxysm, and one of the chief difficulties I have is to follow my patients. They will get apparently well, and will think "this is all humbug; I don't feel nervous; I am not going to have a paroxysm for six or eight months, and I will let the thing drop."

Dr. D. Bryson Delavan, New York City. The Doctor has referred to one of the most important points in view in bringing forward this discussion. It can not be too vigorously emphasized. We so often see patients and physicians putting off treatment of this disease until the attack begins. The golden opportunity for treatment, according to my experience, is the interval between the attacks, especially in those cases where there is present any nasal or constitutional trouble. I have seen cases in which during the intervals between the

attacks the nasal condition seemed to be normal, and although I have used my best endeavor to find an abnormality, I have not succeeded. However, we commonly have hypertrophic conditions, catarrh, exostosis, nasal polypus, and various other deformities present, and these conditions persist, to a greater or less degree, throughout the year. We can all agree to the following propositions: First, that the general condition of the patient should be kept up to the best possible limit: second, that the best opportunity for relieving the patient will be found between the attacks, when abnormal conditions of the nose should be treated, whether by surgical or therapeutical measures to be determined by the nature of a given case; and, third, that during the attack the treatment applied should have for its prime object the alleviation of the existing symptoms.

In regard to treatment during the attack, I think it would not be unwise for this body to place itself on record as distinctly opposed to the indiscriminate and careless use of cocaine. What one of the gentlemen said with regard to this matter in his locality might have been said, I think, by everyone present. We all find it commonly used and commonly abused. It is a source of a great deal of injury, and I wish we might go on record as opposing the evil.

Finally, the fact has not been touched upon, although we all recognize it, that when our therapeutical and surgical means are exhausted certain relief may be obtained by placing the patient in a proper climate, where he may enjoy immunity from his attacks. I believe that in this class of cases, where the patient can be sent away during the time he is having his attack, and where he can be treated between the periods of expected attack, in time the attacks may be entirely done away with in a fair proportion of instances.

Dr. John N. Mackenzie, Baltimore. I wish to indorse what Dr. Delavan has said in regard to the use of cocaine. I have long since given it up in the treatment of this disease except as a purely palliative measure. At a meeting of the Laryngological Association some years ago in Detroit I called attention to the fact, shortly after the drug was brought over to this country, that the time came sooner or later when cocaine dilated the blood vessels in the mucous membrane of the throat and nasal passages, and I think that point is now perfectly well established, and Dr. Delavan's denunciation of its indiscriminate use is correct. But there is another point not generally known, namely, the evil effect menthol sometimes produces. I know of two cases in the practice of a fellow practitioner in which menthol has given rise to brain symptoms similar to those cocaine produces. The patients were both singers and had learned that a little menthol squirted into the nose with an eye dropper just before they were going to sing would make their voices more resonant, so it had become their practice every time they were to sing to drop in a little of this seemingly harmless thing, and finally the friends of one of them noticed that she was having hallucinations and that her mind was becoming otherwise affected. This was spoken of to a physician, and when she ceased taking the menthol all her bad symptoms disappeared. The other case was affected in the same way and on discontinuing the use of menthol became well again.

THE ULTIMATE PROGNOSIS IN NEGLECTED ADENOID HYPERTROPHY.

By D. BRYSON DELAVAN, M. D., of New York.

The effects of adenoid hypertrophy upon the general well being of the patient have been so thoroughly exploited during the past ten years that they are, or should be, abundantly recognized and understood by all practitioners of medicine. To discuss the injury to the hearing, the deformities of the jaw, the nasal cavities, the face and the thorax, the defects of speech, or the impairment of nutrition due

to adenoid hypertrophy would be to present facts which are already sufficiently familiar. It will be the object of this paper to avoid the above considerations, and to invite attention to a series of important conditions which, in the opinion of the writer, are more or less the result of neglected adenoid enlargement, or of incomplete removal of it during attempted operation, but which have not always been recognized as bearing direct relation with that disease.

The existence of the conditions which we are about to consider must depend upon the oft-repeated question: Does adenoid hypertrophy, if left to itself, tend to disappear, leaving the pharyngeal vault in a normal, healthy state? By a universal consensus of opinion, founded upon common observation, the reply is negative. Adenoid hypertrophy, if left to itself, will seldom result in spontaneous cure, no matter what modifications it may undergo, but will usually leave behind it local pathological conditions which may continue for life, to the permanent inconvenience and detriment of the patient. This is proved by the frequency with which the history of preëxisting adenoid hypertrophy is traceable in these cases. The conditions above alluded to are the direct outcome of the structural changes which occur in the third tonsil, as elsewhere, as the result of long-continued inflammation. They may be classified broadly under two heads: (1) A condition of permanent enlargement or thickening. (2) A condition of genuine atrophy. (3) Finally, as a probable subdivision of class 1, we may have the condition known as "Thornwaldt's disease."

Class 1.—The existence of this class of cases is proved without difficulty, since they are commonly met with in practice and easily recognized. Belonging to it are several varieties, which may be summarized briefly as follows:

(1) Cases in which the hypertrophy of childhood remains, with slight diminution in size, until past middle life. Examples of this form may be found in persons well along in life. Indeed, Dr. J. Solis-Cohen has reported one case occurring in a woman of over seventy years of age. Cases are often met with in singers and speakers whose voices show distinct evidence of the pharyngeal disease, and who often fail to obtain satisfactory relief until the offending tissue has been thoroughly removed. The hypertrophy is seldom as pronounced as in childhood, but a sufficient amount remains to constitute a well-marked projection from the pharyngeal vault and a consequent interference with the normal amount of space required for that region.

(2) Cases in which, with considerable diminution in the size of the original growth, a moderate enlargement remains, which in some cases is subject to acute attacks of swelling, during which may be developed, temporarily, a well-marked pharyngeal tumor. In this condition of the vault there often appears, upon examination, to be nothing more than a simple thickening of the mucous membrane without especial significance. In reality, it is the remnant of an early hypertrophy, and constitutes in itself a morbid state, attended with annoying symptoms. This particular class of cases presents several interesting features. Often the usual appearance of the vault differs little from the normal, excepting that the color may be darker than usual and the surface of the mucous membrane somewhat less smooth. The application of the finger tip, however, or of the end of a probe, will demonstrate the presence of a distinct thickening which may be so slight and so generally distributed as to be overlooked, although overlying the whole vault.

(3) The so-called "Thornwaldt's disease" is described as being a chronic inflammation of the "pharyngeal bursa," accompanied with some enlargement, and a discharge from one or more of the crypts or folds at the pharyngeal vault. It appears to be nothing more than a chronic condition resulting from long-standing hypertrophy Certainly it is best treated by the same means which are successful in cases of ordinary hypertrophy, namely, by the removal of the offending tissue.

In all of the above varieties of pharyngeal disease there is commonly present a remarkably persistent catarrhal inflammation, in some cases much more severe than in others, and attended with greater disturbance to adjacent parts, but in nearly all sufficiently well marked to be the cause of distinct annoyance. It is in such cases also that progressive loss of hearing is apt to occur. While the habit of mouth-breathing may have been long ago successfully overcome, the effect upon the voice of the interference with the normal contour of the vault of the pharynx, caused by the thickened tissue projecting into it, and of the presence of the unnatural secretions which more or less occlude it, is particularly unfortunate, materially impairing its richness and tone quality even when it does not interfere with pronunciation.

The second class of cases is one in which the conditions and symptoms are even worse than those of class 1. In them the soft parts of the pharyngeal vault have undergone a distinct atrophy. Their anatomical structures have either been completely destroyed or else so modified that they are no longer able to perform their normal functions and the physiological activity of the parts has thus been destroyed. Local symptoms of a distressing nature also are set up and a most unfortunate state of affairs is the final result. It is not claimed, of course, that all cases of atrophic catarrh of the vault are consecutive to adenoid hypertrophy. On the contrary, it is not uncommon to find this disease in patients who, to all appearance, and so far as their histories go, have been remarkably free from lymphoid enlargements of all kinds. Nevertheless, severe degrees of dry pharyngeal catarrh are not seldom found in patients in whom unmistakable evidences of preexisting adenoids are present.

If the conditions described under class 1 are objectionable, those last mentioned are far more so, both with regard to the discomfort and annoyance which go with them and to the extreme difficulty which attends their cure. All, however, are objectionable in a high degree and eminently calculated to add to the burdens of life, while detracting from the comfort and general usefulness of the patient.

To sum up, it appears: (1) That there are several pathological conditions of the upper pharynx found in adult life. (2) That these conditions are common. (3) That where they are present the history of preëxisting adenoid hypertrophy can often be distinctly traced. (4) That the conditions which are present in these cases of adult disease are such as would have resulted naturally from the effects of long-continued inflammatory action upon the parts concerned. (5) The above premises being true, it is impossible to avoid the inference that prompt and efficient treatment of the original adenoid enlargement would have removed the chief cause of the subsequent disease, and thus have prevented much injury and suffering.

The great frequency therefore with which disease of the vault of the pharynx, due to neglected adenoid hypertrophy, is found, the serious character of the conditions resulting from it, and the great difficulty often experienced in overcoming them, all bear testimony to the fact that, on the whole, adenoid hypertrophy does not tend to spontaneous cure; that when present, in any marked degree, it demands thorough treatment, and finally that if left to itself in the hope of spontaneous cure the ultimate prognosis is bad.

The practical application of the above conclusions is obvious. Adenoid hypertrophy is a disease which is always likely to be injurious. Its effects are not confined to childhood, but may follow the patient as long as he lives; and with regard to its treatment, the greatest amount of evil is to be avoided and a maximum of good obtained by its early, thorough, and complete removal.

DISCUSSION.

Dr. PRICE-BROWN, Toronto. I would like to ask whether the Doctor finds a greater proportion of cases of hypertrophy in the adenoids in males or females; also whether there is any direct hereditary tendency to the disease? As a rule, I have found a larger number occurring in males than females. In children who have been brought to me for treatment of adenoids, I have frequently found that where the father had the disease, the sons had it also. I would like to know whether there is any connection between the two.

Dr. D. BRYSON DELAVAN, New York City. In answer to Dr. Brown, I have not observed any distinct preponderance in either sex. There is no question as to the possibility of heredity. Either the child inherits the adenitis itself or he inherits tertiary syphilis, or tuberculosis, which may develop adenitis, which amounts to the same thing. As to nationality, that nation will have the most adenitis which is the most exposed to damp, changeable, chilly weather, and perhaps to tuberculosis and the various diatheses that accompany bad climatic surroundings, although in the healthiest American types adenoid enlargement may be found. The subject of the paper is the tendency of neglected adenitis to continue as a source of irritation and disease during adult life, and it was for that point alone the paper was presented, because I think sometimes this tendency to degeneration and permanent pathological results is not sufficiently realized.

THE EFFECTS ON THE VOCAL CORDS OF IMPROPER METHOD IN SINGING.

By H. HOLBROOK CURTIS, M. D., of New York.

It would be strange indeed if a laryngologist who was daily in the habit of examining very many throats of singers did not have his attention particularly attracted to the difference in the appearance of the glottis as the direct result of different methods of voice production.

Several years ago, as early as 1884, I observed that many pupils of a certain professor of singing presented marked peculiarities in regard to the position of the free borders of the vocal bands. The slightly elliptical shape of the chink of the glottis, which this class of pupils presented in emitting the usual sounds to allow the proper view of the larynx, led me to inquire as to the particular method of teaching which would produce in so many throats a typical appearance. I soon found out that these pupils were in the habit of taking daily exercises almost entirely on a single vowel, and that single vowel being the letter "o." The vocal cords appeared striated, with frequently a congested area at their anterior attachment. Frequently a nodule, more or less defined, would be observed about the center of the free edges on either cord. This is a picture which every laryngologist will recognize. Another type of which the study is most interesting is that of a class of pupils undergoing instruction at a conservatory where that pernicious French method, the so-called stroke of the glottis (*coup de glotte*), is daily practiced. In this type the writer has observed the middle-third of the cords to be slightly bulged, the cords presenting a convexity in contradistinction to the concavity exhibited in the last group.

These pupils had been singing chiefly on the vowel "a," pronounced as "ah" in English, and with the emission of each note the middle portion of the cords would clash, and by constant attrition become hardened and callous. The cords in this particular type do not usually show congestion; their appearance is usually of a

good pearl color, and healthy looking in every way. The complaint which they make upon consultation is a difficulty in singing the so-called mezzo voce and a lack of richness of tone and timbre, with extreme weakness of two or three notes in the upper medium register. It was these two opposite appearances of vocal cords, which are every day observed in singers' throats, that led to an investigation of methods employed by the various schools of singing, and has opened up a field which I think has been entirely neglected, though of the greatest importance to every laryngologist who has to do with singers.

Two names are intimately linked with the traditions of method in singing: those of the elder Lamperti (that illustrious exponent of the best Italian school), and Mandl, who, by his ingenious arguments, though founded on a false physiological basis, succeeded in completely overturning the art of voice production which previously had been taught throughout Europe. He substituted in place of the so-called Italian school a method of abdominal respiration which was at once adopted in the Paris conservatory, and has obtained to within the last three years an almost universal recognition in the best schools of the Continent.

It is the writer's purpose, without going too deeply into the history of singing, to discuss the various methods of respiration and initial tone production, and to show by a series of experiments made upon individuals the effects of certain methods of voice building, hoping to arrive at some definite conclusion as regards the proper exercise and position of the larynx, and consequently proper tension of the vocal cords during tone emission. For the brief historical sketch which I shall give I am indebted almost entirely to the able article of Dr. Joal, of Mont-Dore, which appeared in the Revue de Laryngologie d'Otologie et de Rhinologie, Nos. 8, 9, and 10, 1892, Paris. The position which Dr. Joal occupies at Mont-Dore (the favorite resort of almost all the European artists) has enabled him to consult freely for a number of years the most distinguished vocal talent in Europe, and his views upon voice production should be carefully read by every instructor who wishes to profit by the exceptional opportunities which that author has enjoyed. One can not read his able discourse upon the singing voice without feeling that his every utterance is *ex cathedra*. In 1842 Beau and Maissait divided the respiration of singers into three characteristic types—the superior costal, inferior costal, and abdominal. The superior costal may be illustrated as the breathing of a woman tightly laced, the respiratory expansion taking place chiefly in the cone of the thoracic cavity, the upper ribs, collar bone, and sternum rising and falling during the respiratory act. In the inferior costal type the inferior ribs (commencing with the seventh downward) are rotated and elevated, the sternum moving only in its inferior portion, the abdominal wall being contracted during the inspiratory act. In the true abdominal type, the thorax is supposed to remain completely fixed, the diaphragm, taking the ribs as a fixed point, lowering the abdominal viscera, thus distending the wall of the abdomen in inspiration. It is this latter type of breathing which has been taught for the last thirty years in France.

Mengozzi, together with the masters of one of the conservatories, determined upon the following rules illustrative of the breathing of singers:

The respiratory act in singing differs somewhat from that used in speaking. In speaking the abdomen is distended in inspiration and recedes in expiration, while in singing the abdomen must be drawn in during inspiration, returning slowly to its natural state as the chest contracts in expiration; thus retaining as a negative force the air which has been introduced into the lungs.

In a revision of this method, published in 1866 by Baptiste, these laws are repeated with the addition of a note by Dr. Mandl (the apostle of abdominal respiration) who advocates the advancing of the abdomen in inspiration. Mandl carried his point, and his ideas became generally adopted by the conservatory. M. Bonheur and Dr. Cheval, of Brussels, advocated the superior costal type of breath-

ing in contradistinction to the method of Mandl. Mandl in his work states that the larynx becomes very much depressed and the glottis enlarged in the costal method of respiration. Joal answers him in these words:

We do not find this depression of the larynx referred to in any of our classical treatises on physiology, anatomy, nor in any of the numerous works which have appeared since 1855 on laryngology; consequently we suppose that writers do not share the ideas of Mandl on the subject. Besides we have examined a number of persons whom we engaged to breathe alternately from the abdomen and from the shoulders. We ourselves, in singing, have often observed the movement of our larynx and we have never observed that the clavicular inspiration caused the thyroid to fall.

Nicaise explains this fact by demonstrating experimentally that during strong inspiration the trachea contracts and becomes shorter, which draws down the larynx.*

It is very difficult for a professional man to take cases of distinguished singers in his own private practice and hold them up by name as models of perfection of certain types. Joal made the assertion, in an article published in 1890, that great artists. especially women, used the superior costal method. The distinguished critic of Le Temps challenged Dr. Joal at once to mention some of these artists. The Doctor responded:

I would be happy to gratify Mr. Weber's desire, but it is very difficult for a physician to go into personalities and to say that a certain singer is using a vocal method considered disastrous and execrable by masters of criticism.

Melchissedec, however, offered himself as an example of the superior costal respiration, saying that it had enabled him to sing constantly for twenty-five years. Both his strength of tone and his tremendous endurance, with an almost perfect glottis, attest that the method has not been injurious to him.

The abdominal method of breathing has many powerful advocates. M. Obin and M. Faure, for example, speak most highly of it; Shakespeare, of London, Behnke, and Lennox-Brown are also its advocates. The instructors of both methods are very apt to quote great artists as the exponents of their particular school. Joal cites the case of Rubini, the celebrated tenor, whom Massini and his pupils declare originated abdominal respiration. Bonheur, on the contrary, states that he expanded his upper chest, Walshe even going so far as to say that he fractured his collar bone in making a violent effort to reach "B flat" in "The Talisman of Pacini." Lablache and Laget acknowledged that in spite of long and attentive observation they had not been able to distinguish in the theater how this illustrious tenor breathed. Joal goes on to state that the famous Lamperti is alternately represented as a partisan or opponent of the abdominal type of breathing; but I think that, having treated many of the elder Lamperti's pupils and interrogated them very particularly upon this question, I may unhesitatingly affirm that the elder Lamperti was a strong advocate of the lower costal respiration, always arguing that the abdominal wall should remain quiet or be slightly drawn in during inspiration. The evidence of Campanini, Jean de Reszke and Clara Heyen is in support of the above. Joal says if we except the works of Laget and Bonheur, we find nowhere the praise of clavicular breathing in men. The ancient method of the Paris Conservatory and the works of Maunstein, Caruth, and Manuel Garcia all advise thoracic respiration by the elevation of the ribs and drawing in of the abdomen.

If we take up any work on the voice and study the photographic appearances of the cords during the emission of certain notes, we remark that the cords are not vibrating longitudinally, but that their free borders approximate, touch, or overlap, and that the posterior opening of the chink is longer or shorter, and different

* Revue de Medicin, 1889.

in appearance for each note. I wish to put on record here my opinion of the absolute impossibility of photographing the vocal cords during the proper emission of tone, from the very fact that the laryngoscopic mirror placed in the pharynx interferes with the right focus of the respiratory attack, and it is only possible to observe the vocal cords in the photograph when the so-called stroke of the glottis is used in the emission of a note. The photographs of singers' cords and the deductions which have been drawn from their appearance during the emission of different notes only demonstrate, in every case that I have ever seen, that the larynx is elevated by the pulling up of the thyroid, the cords relaxed, and the free borders more or less approximated.

If we ask a singer who is in the habit of using the so-called "high-chest method" of costal respiration to take a note (the attack entirely taken from the cords and focused in the masque, bringing into play the harmonics lent by the sound waves passing behind the uvula and soft palate), introducing the smallest possible size of mirror, so that the color given to the note by nature's resonance pipes, the antra and nasal cavities, will be as little as possible interfered with, we are surprised to find that on the emission of every note of the soprano medium register the cords appear equidistant from each other throughout the entire extent that it is possible to see them.

The part which the intrinsic muscles of the larynx play in the tension of the vocal cords becomes an interesting study. It is very easy for us to see by the depression of the thyroid how the cords must be elongated, but it is extremely difficult for us to comprehend the minute differences of tension caused by the movements of the thyro-arytenoid and crico-arytenoid muscles. I have frequently been surprised, upon examination of the vocal cords with the head held down, the chin resting upon the chest, to find the cords present a beautiful pearly appearance, entirely homogeneous, but upon attempting to show the patient his own cords by an adjustment of double mirrors, the head being slightly thrown back, upon the same note the cords suddenly have become dusky, semi-congested, and striated. How much of this is due to the slight elevation of the thyroid cartilage, and how much to the intrinsic muscles of the larynx or to the relationship between the chink of the glottis and the trachea, it is difficult to determine. To a careful study of these differences of tension am I indebted for the discovery of a fact which I here write about for the first time, the appreciation of which fact, however, has entirely changed my treatment of the singing larynx, and has caused me to institute a system of tone exercises by which certain intrinsic muscles of the larynx are so strengthened that any medical application through the medium of sprays, probangs, and, I may say, instrumentation, has ofttimes been entirely done away with.

If we take a good-sized laryngoscopic mirror, No. 4, for example, and ask a patient to sing "E" or "Ah," the cords come into view for two reasons: First, the epiglottis becomes more perpendicular, allowing a better view of the bands, and secondly, the cords themselves are on a more elevated plane, owing to a slight elevation of the thyroid cartilage and consequent relaxation of the intrinsic tensors of the cords. In this position we remark that the free borders of the cords come together in the anterior and central portions, and we are able to study the initial tone attack, the membrane separating as the tone bursts through the closed chink. This picture may be said to be an imitation on a small scale of the so-called stroke of the glottis. In this method of producing a tone, the initial attack being upon the cords themselves, the central portions of the cords necessarily touch. The peculiar muscular equilibrium which is employed in this mode of attack invites a reflex elevation of the soft palate, cutting off the oral from the nasal cavities. As we look at this picture our minds revert to the singing teacher who commands her pupils to keep their palates up, sing in the back of their heads and strike the glottis.

Could ever villainy be more compounded? Let us take the same patient and require him to sing the same note, but in an entirely different way. We will first ask him to expand his upper chest, not necessarily by respiration, but by elevation of the superior ribs by a muscular effort, at the same time slightly drawing in the abdominal wall. We now introduce the smallest mirror and ask our patient to sing "A," pronounced as in "law" or "maw." With this position of the larynx and muscular poise, we observe two things: First, the epiglottis does not assume its most vertical aspect, not inclining as near the perpendicular, and the soft palate and uvula do not spring upward and backward to make the partition between the mouth and the naso-pharynx. Different in every respect is the tone produced by the cords, which may be assumed to vibrate longitudinally, but never touching each other in the middle portion, even in making the initial attack. The cords appear narrower, tenser, lower anteriorly, equidistant from each other, more homogeneous and whiter in color.

These two pictures should be well considered, as they become the basis of criticism in distinguishing the correct and eliminating incorrect methods, on the one hand, in singer's voices, and of the greatest assistance to the laryngologist in correcting pathological conditions, the result of bad training. The proper appreciation of these opposite conditions and their effect on the quality of tone immediately calls our attention to the subject of respiration. Within the past three years the entire theory of musical education has changed in France. The explanation of this change being that there is at present a better appreciation of the influences bearing upon the production of tone, and a better understanding of the physiology of the larynx by reason of the advances made in laryngoscopy. Modern teaching tends to cultivate tone harmonies and sympatica in the voice at the expense of brilliancy of execution. The same judgment should be exercised in the training of an individual who proposes to make singing his or her art as should be employed in advising the painter that his special forte lies in landscapes, rich in color, to which he may give expression to his imaginative genius, rather than to the sterner fac simile of portraiture. How many singers we hear whose technique and brilliant staccato in the Bell Song of Lakme calls forth our admiration and amazement, but who are absolutely unable to put any sympatica whatsoever into the simplest ballad. We should study color harmonies in music in the same way that they must be studied in painting. There is no rule for the palpitating sunlight effects and prismatic play of colors in the school of Claude Monet; it is certainly a subtle feeling which is given by an ingenious mingling of pure spectrum colors.

In the human voice, that added coloring of tone which appeals to the heart as well as to the ear of the listener must be brought about by the employment of those harmonies which are added to the original tone by intervibrations within the accessory cavities of the nasal passages. To sing *dans le masque*, as the French say, is to give this added richness to the initial tone; but to sing in this manner requires the soft palate and uvula to be lowered in the production of tone. Likewise, to make the purest initial tone from the cords we must get the utmost possible tension, which may only be arrived at when the thyroid is depressed; for, in proportion as the thyroid is elevated, the cords tend to assume the base of a right angle triangle instead of its hypothenuse. Several elements beside this enter into the question of greatest possible tension, one of the most important of which is, that the trachea be drawn down to assume the position that it takes when the apices of the lungs are filled to their greatest extent with air. One of the greatest singers that the world has ever known told me that the reason that he adopted a fixed high chest was that he had found, after the removal of a papilloma from one of his cords, that the only way in which he could be at all sure of his voice while singing was the maintenance of the so-called "high-chest respiration." This is

easily explained by the fact that in this position the upper ribs remaining fixed, the apices of the lungs always remain in contact with the thoracic wall, expanded to their fullest extent, the cords being kept in their state of greatest possible tension. In this position the breathing becomes entirely inferior, costal, and diaphragmatic. The position of the thorax, as indicated above, permits the lungs to expand to their fullest extent, thus adding a secondary resonance to the voice from below—a sort of complementary timbre—the fixed upper thorax allowing of the least possible change of color during tone production.

It is this combination of facial and thoracic tone fortification which gives the enormous carrying power to tones produced by this method. For a number of years, before I made a special study and estimated the great significance of these factors in singing, I have deluged the throats of singers with sedative and astringent sprays when their cords appeared congested and swollen, often presenting nodules in their center which I had never previously recognized as being due entirely to singing with an improperly poised larynx.

I may cite several cases to show you the difference, from a medical standpoint, in the treatment of the singer's throat, where I now substitute respiratory and tone exercise for the amelioration of conditions, that I have always been taught were only to be cured by rest and the diligent use of drugs. The cases I cite are typical of a class of singers that I have treated with equally good results since I have made a particular study of the peculiar value of the proper tone production in the human voice.

The 1st day of January last I was consulted by Miss F., age 23, who had had a contralto voice of large power, which she had employed constantly for several years, and had finally, after a prolonged concert tour with a well-known orchestra, entirely broken down. Her cords were dark red, with a slight nodule in the middle of either band. She complained of great pain in producing her notes, and her medium register had no power in it whatsoever. She had been told by two of the best authorities on the throat that she must not sing a note for a year, and must have her cords painted with astringent solutions and tone up her general health. Upon testing her voice, I remarked an extremely breathy tone and clavicular respiration. In accordance with the principles which I have attempted to demonstrate, I forbade her speaking a single word for a week, but placed her at once upon the so-called "inferior costal respiration," maintaining a high chest, and giving her direction to take a medium "C" with the chin almost resting upon the clavicle singing the word "ma" for five minutes of each hour of the day, the tone first to be focused in the face with the mouth closed and the attack to break upon the lips as much as possible on opening the mouth. At the end of seven days the cords, instead of presenting an elliptical appearance, were straight, and the nodule was so far rotated upward on either cord that it did not touch the nodule of the opposite side in the emission of tone. At the end of the week this young lady, who considered her voice hopelessly destroyed, having acquired a new method of respiration, sang in a concert. She has since sung regularly in church, in many oratorios during the winter, and is at present singing three times a week in grand opera, learning new rôles continually, apparently perfectly restored. She tells me her voice is far more powerful than she had ever dreamed of.

Case 2.—Miss P. H. consulted me on March 2, in great distress. She was obliged to sing in a comic opera on that evening or close the theater. Examination showed inflamed and bulged cords, with great hoarseness in the speaking voice; middle register impossible, but the high notes obtained with great effort. I sent her at once to my assistant, who gave her exercises to maintain tension, and at the end of an hour's work with tension exercises and inferior costal breathing the cords responded and she sang with ease.

Case 3.—Miss H. B. consulted me in May, having lost her position as prima donna by reason of loss of voice. Had been constantly treated. Her cords showed the nodules of attrition, the result of the employment of the *coup de glotte* and faulty respiration. In this case a week's work caused the nodules to disappear. She adopted a proper laryngeal poise and again assumed the leading rôle.

Observation.—In this class of cases rest causes a relaxation of the cords and singing becomes impossible for some time, whereas constant work with tension of the cords and nonapproximation of the same gives immediate relief.

Case 4.—Fraulein K. consulted me in the spring. Her cords appeared swollen and the membrane was injured but not hyperæmic. Had been obliged to cancel her engagements and return to New York for treatment. I recognized the familiar picture and sent her to my assistant, who cured her in a week without other treatment than the establishment of a proper laryngeal poise.

With many cases like these which I might cite, may I not be excused in calling attention to what I consider the most important ground principle of the singer's art, namely, the proper employment of the muscles of respiration, the poise given the cords, and the proper use of the intrinsic muscles of the larynx, not forgetting the bringing into play of the accessory resonance cavities of the face, which lend so much color to the tone, removing entirely from the cords the deleterious effects of an improper initial attack?

To rehearse briefly the deductions which I have attempted to draw from my argument, I maintain that the best method of respiration is the inferior costal or diaphragmatic, faithfully maintaining the elevation of the upper ribs without raising the shoulders. Next in importance is the depression of the thyroid cartilage, brought about through the agency of the crico-thyroid muscle, and the pulling down of the trachea by increasing the capacity of the upper lobes of the lung. Be careful that the initial attack is removed entirely from the cords. Lower the uvula and soft palate that the sound waves may obtain their intercurrent vibrations or harmonics by partly passing into the nasal cavities from behind. Let us not fall into the error that the roof of the mouth alone is the sounding board of the singing voice, for without that added richness and timbre to be given by calling into play nature's resonance pipes, the nose and its accessory cavities, we may sing, but the singing is at the expense of the cords and the life of the voice is necessarily shortened. If I have said enough to arouse a new interest in what I consider a most necessary accessory to laryngology I shall feel amply repaid for my endeavors to set the theme before you in a clear and comprehensive manner.

DISCUSSION.

Dr. John N. Mackenzie, Baltimore. I have nothing to add to the admirable paper of Dr. Curtis, except to second what he says concerning the vast importance of vocal gymnastic exercises in the treatment of affections such as he describes. In his office last May I saw a very striking illustration of its power for good in the person of the first case he has reported. I think this whole question of vocal gymnastics is going to play a very important rôle hereafter in the treatment of minor affections of the vocal apparatus.

Dr. H. Holbrook Curtis, New York City. I wish to dwell upon the importance of this question and the interest it should arouse, because, as Dr. McKenzie has said, it is in the hyperæmic conditions where we encounter chronic affections of the vocal cords from lack of tension, the cords with nodules in the center, where the person is hoarse in the morning and hoarse after singing. It is in those cases that gymnastic exercises of the intrinsic muscles do so much good. I took a choir singer in New York who had lost her voice from a papilloma on the cord. After scraping the cord I put her on these exercises, and she recovered her voice with a brilliancy it had never possessed before. She has since adopted this system of teaching for a livelihood, and does nothing else except give these exercises to singers, thereby making a very comfortable income. Professional people who go to her recommend her to others. This has shown me that we have been groping around for a long time in this condition of the cords, trying to cure them by electricity and in various ways, whereas the true principle of treatment should be the cultivation of the proper poise of the larynx, and practicing mild tension

of the cords, in order that they do not touch when making the initial tones. By taking these exercises constantly, you pull a cord from a bulging condition into normal straightness without the loss of a day's work, and this is important to singers and actors. You can take a man with chronic laryngitis, who has perhaps been drinking a good deal, and in a couple of days he may be put in good condition, whereas by the old method it would take a couple of weeks.

ASPERGILLUS MYCOSIS OF THE MAXILLARY ANTRUM.

By Dr. JOHN N. MACKENZIE, of Baltimore, Md.

I was not aware until I arrived in Washington that a paper was expected of me. This fact, together with the intense heat, compels me to read a paper which I have not yet written. In the early part of last November I presented a case before the Johns Hopkins Medical Society which will furnish the text for my remarks to-day.

I wish to call your attention to a new disease of the antrum. As far as I can find from consulting literature the condition was never described until I presented this case, which was that of a young lady who, in 1883, consulted Dr. Theobald, of Baltimore, on account of pain in the right ear, which he said was as well marked a case of pure otalgia as one would ever see. This was the usual symptom that would bring her to see him from time to time. Often there was nothing wrong to be seen in the ear, but at other times there would be a swelling of the outer third of the meatus and tenderness on pressure. March 4, 1889, a threatening furuncle appeared in the auditory canal; in October, 1887, an abscess of the lobe of the ear, which was opened by Dr. Theobald. There never was at any time aspergillus in the ear, nor even a condition which would suggest a probability of its presence. Dr. Theobald first noticed a swelling on the right side of the face January 7, 1889, and a week later recognized the presence of a disease of the antrum, she having had a discharge of pus from the nose with relief of pain and diminution of swelling of the cheek in the meantime. February 27, 1891, he noticed some swelling over the root of the nose, with pain over the right eye, and he feared there was trouble beginning in the frontal sinuses. These symptoms disappeared later. Dr. Theobald was disposed to think that the disease in the antrum had something to do with the ear symptom, and perhaps was the chief cause of the otalgia which she had from time to time. About two years ago her dentist brought her to Baltimore in consultation with Dr. James H. Harris, and from the history which Dr. Harris got of her antral trouble he seemed to think that the trouble was due in the first instance to caries of a molar tooth possibly originating as a variety of periodontal inflammation, with subsequent antral trouble. The antrum was opened at that time (the second molar tooth was extracted, and the floor perforated by a large drill) and an immense amount of pus washed out with a syringe. She was seen subsequently by several general surgeons who insisted upon scraping out the antrum. She was a little afraid of the operation and declined it. So things have been going on for the past two years, the antrum being syringed out daily with various alterative, astringent, and antiseptic solutions. The only drug which seemed to give her any relief at all was nitrate of silver in strong solution. This would stop the discharge for a week or two, and then it would become as bad as ever.

One of the chief points of interest in this case was the passage from the antrum of large quantities of false membrane. You all know that Zuckerkandl, who, above all other German investigators, has thrown light upon antral troubles, says that the structure of the antral mucous membrane is such as to preclude the formation of false membrane; therefore he denies the possibility of any diphtheritic membrane forming in the antrum. This case, of course, overthrows this postulate of Zucker-

kandl's. The membrane was a well-formed false membrane and it was passed from the antrum in large quantities during weeks and weeks. I obtained some of the membrane and sent it to Dr. Flexner, assistant pathologist at the Johns Hopkins University. Dr. Flexner has all my preparations, and as he is in Europe now I am not able to show you the beautiful work he has done, but shall have to content myself with a description of the microscopical appearance.

The membrane consists of three layers. The first layer consists of a mass of round cells with some loose epithelium of the mucous membrane of the sinus. The second layer is apparently one of pure necrosis, which does not stain. Upon this layer rests a mass of the so-called aspergilli. Dr. Flexner inclines to the belief that it is the aspergillus fumigatus. The aspergillus sends its spores in two directions, off from the free surface and down into the deep layers.

The subject of aspergillus infection is receiving some attention at the present day. Apparently very little is known about it. Of course we are all familiar with the fact that the aspergillus frequently infects the auditory canal and is also found on the cornea. The variety that is found in the auditory canal and on the cornea is the aspergillus niger, which is the least infectious of the three main varieties of aspergillus: these are the niger, the flavus, and the fumigatus. There seems to be more danger connected with the fumigatus than with either of its brethren, the niger or the flavus. Aspergillus infection is quite common among some birds, for example, the dove and various other smaller birds. Flügge states that it is found quite commonly in zoological gardens among the animals, aspergillus fumigatus being the variety most often met with; it is inhaled and sets up a pneumonia, which differs from ordinary pneumonia in that it proceeds rapidly to necrosis of the lung tissue.

Aspergilli seem to flourish best on moist soil and on mucous membranes where the epithelium has become moistened and loosened; they are sometimes produced by injections of oily matter. I have very carefully gone into the history of this case and find no reason to believe that at any period of her trouble was fluid injected into the antrum which might have brought the aspergillus spores. They may have lain there dormant for months. According to the natural history of these parasites, they may remain on a membrane a considerable time before evidence of their existence is forthcoming. We rarely see parasites in the nasal passages or the accessory cavities in our climate; they are found in southern climates, as you know. As I have not the sections here to show you, I will read a short extract from Dr. Flexner's report:

The thickness of the separate layers did not exceed 3 to 4 mm. and the membrane was found to be very friable. Sections showed on microscopical examination several layers. The undermost layer was composed of polynuclear leucocytes. This varied in thickness in different parts and formed about one-third of the entire thickness of the false membrane. A few cells of a different type, larger, with more protoplasm and vesicular nuclei, being sometimes flat and scale-like, and again narrow, elongated, and columnar, were present in the layer of leucocytic aggregation. These epithelial cells presented evidences of degeneration in the staining properties of the protoplasm as well as in the shriveled appearance and diffuse staining of the nuclei. Above the layer of leucocytes an indefinite substance was found, composed of granules and fiber-like processes which stained poorly in hæmatoxylin and eosine. But in the specimens stained in Weigert's fibrin stain this layer was seen to be felted and composed in large part of mycelia of a fungus. The uppermost layer of the membrane is composed of branches from the mycelia below, bearing on their summits the fruit-bearing heads. The fungus was recognized as belonging to the aspergilli, and Dr. Lotzy, who examined the specimen, finds it to be the aspergillus fumigatus.

This subject which I have brought before you is a twice-told tale; I have presented it to the Johns Hopkins Society and the American Laryngological Association. As far as I can make out, this is an entirely new disease added to our list of antral affections.

DISCUSSION.

Dr. MERRICK. Dr. Mackenzie has certainly presented a very interesting paper, but I should like to know what means of treatment were adopted and with what degree of success.

Dr. MACKENZIE. I only saw the case twice in consultation. The patient lives at a distance from Baltimore, and I have not yet received the final report of her attending physician. All sorts of things were used—nitrate of silver, zinc, iron, iodoform packing, and almost everything you could think of. The only thing that seemed to do any good, and that only temporarily, was the application of a strong solution of nitrate of silver to the antral cavity. Of course the only way to get rid of the trouble is to scrape the disease out of the antrum, but that she will not have done.

HYSTERICAL APHONIA AND DEAFNESS.

By E. FLETCHER INGALS, A. M., M. D., of Chicago, Ill.

Hysterical aphonia is so common that little of interest can be said concerning it, but hysterical deafness is comparatively rare. I find reports of a few cases, but have never met with it myself, excepting in a single instance, a brief history of which I think will be of interest to this congress. The case is that of Miss P. A. J., aged 23 years, and a teacher by profession, who recently came to America from Ceylon. She had been annoyed for three years by weakness of the voice, and occasionally by complete aphonia, and had been slightly deaf. About two years ago, while making an ocean voyage, she was greatly alarmed by a rat springing upon her. Immediately thereafter she lost the sense of hearing, and since that time has been so deaf that she could not hear ordinary conversation, and could only understand when addressed in very loud tones with the person's lips close to her ear.

When she came to see me, in the early part of July, 1893, she was still extremely nervous, and complained of dryness in the throat, inability to speak excepting in a whisper, and deafness so great as to require shouting to enable her to hear. Her general health was good; there was no history of predisposition to disease; pulse 100, temperature 100°; no cough or expectoration; appetite fair, and digestion normal. The hearing, tested by an ordinary watch, showed that no sounds whatever were appreciated even when the watch was placed in contact with the ear or temporal bones. The left membrana tympani was considerably thickened; the right normal. There was no congestion of the larynx, and the cords were well approximated on attempted phonation; but this condition could not be maintained. She talked only in a whisper, but upon directing her to sound the letter "a," while examining her larynx, I found that she could easily produce loud sounds. The excitation of pulse and elevation of temperature were temporary. I applied a mild astringent spray to the larynx and a solution of menthol, 5 grains to the ounce of liquid albolene, to the Eustachian tubes, through the naso-pharynx, the application being made by a long-tipped Davidson's No. 59 atomizer, which was introduced back of the palate, the spray being driven in with an air pressure of 15 pounds, while the nostrils were tightly closed. She was given internally berberine muriate, 1 grain; extract of valerian, 2 grains, and strychnine sulphate in doses of one-twentieth of a grain, which I proposed to increase rapidly to one-tenth or even one-eighth of a grain. Three days later it was noted that she felt something better, stating there was a "softening" in the ears, and seven days after the first treatment her friends stated that she occasionally spoke aloud, though in a low voice, and that her hearing was decidedly improved. At this time

the dose of strychnine was increased to one-sixteenth of a grain, and three days later to one-twelfth of a grain, four times daily. Four days later it was increased one-tenth of a grain and combined with extract of valerian, 2 grains, and asafœtida, 3 grains, which she took for five days, when (nineteen days after the beginning) one-eighth of a grain of strychnine was ordered in the same combination. This she took four times before the toxic effects of the strychnine became manifest. It was continued, notwithstanding the spasms, for two days subsequently and then reduced to two doses per day for five days. The convulsive movements continued to occur at evening for a couple of days after diminution of the quantity of strychnine, and then disappeared. The following day the friends reported that her hearing was greatly improved. Two days later (one month after beginning treatment) her hearing was apparently much improved for ordinary conversation. She talked aloud much of the time, but occasionally lapsed into whispers. The dose of strychnine was again increased to one-tenth of a grain four times a day and given in combination with extract of valerian, 3 grains. The strychnine will be continued in sufficient doses to cause slight twitching of the muscles, electricity will be used, and at the same time some simple topical application containing a small amount of menthol, for its physical effect. The case is still under treatment.

DISCUSSION.

Dr. S. K. Merrick, Baltimore. This case is certainly one of great interest, the like of which I have never seen. I have, of course, had cases of hysterical aphonia. I would like to ask whether Dr. Ingals considers this a case of uncomplicated hysterical deafness? I understood him to say there was some reddening of the membrane. It occurs to me the length of time in securing results might throw some doubt upon the question of its being entirely of hysterical origin. Within the last six months a young girl came to my office, accompanied by her sister as spokeswoman. She was unable to speak at all except in a whisper. She said she felt perfectly well otherwise; there was no history of hysteria, nothing to indicate that it was a case of hysterical aphonia, yet on closer examination I found the larynx perfectly normal. There is one suggestive point in Dr. Ingals's paper—one remedy I had never used until I used it in this case. I was satisfied of the diagnosis and assured the girl that her voice would be instantaneously cured—it had been three days since she had spoken. It occurred to me menthol would be an excellent thing to use. She took three inhalations with 20 pounds pressure, and immediately spoke, talking as well as anybody, and she has never had any subsequent trouble. I think we usually get good results very quickly in these cases if there is no other element standing in a causative relation.

Dr. H. Holbrook Curtis, New York City. I have had one case of hysterical aphonia associated with deafness, but it never occurred to me until I heard this paper that there was an association between the hysteria and the deafness. The cure was made in the following way: The lady went out sailing, and in going ashore on a small boat stepped on the rail and went down between the boat and the yacht. She screamed for help, and from that moment she spoke; and, as I remember now, her deafness is much better; in fact, I have not heard her allude to it since. In all the cases I have seen of aphonia which might be considered hysterical, I have observed that there was a thickening of the ventricular bands.

Dr. James E. Logan, Kansas City, Mo. For the last two weeks I have been attending a case, not of hysterical deafness, but of hysterical aphonia, which was pronounced, but did not recover as I expected it to, and I simply state the case in order that I may get some information in regard it. I have made a close examination of the case. I can see the condition of the larynx perfectly, and the only thing

I can find there is a considerable thickening of the ventricular bands, but no inflammation. She has spoken in a whisper for six months, but when I ask her to sound the letter "a," or "ah," she speaks it distinctly, and she coughs distinctly. She was sent to me by physicians in Indian Territory with what they thought was tubercular laryngitis. There is no evidence of bacilli, no enlargement except of these bands. I can look down the trachea and can find no evidence of ulceration. I saw a little granulation in the anterior commissure, but with an application of chromic acid it passed away; but it was above the vocal cords and could have given no trouble in that respect. I can not bring about a relief or cure of her condition. She is now at my home, and I am anxious to find something that will relieve her.

This question of hysterical deafness is certainly very interesting. I would like to know the condition of the patient's ear previous to this deafness coming on, as it seems Dr. Ingals found considerable thickening of the left membrane: in that event she certainly could not hear very well out of the left ear, but the right ear being normal makes up for the deficiency, and being so totally deaf I should think was due to the hysterical condition. This question of hysterical aphonia is interesting to me, because I have had several cases and have not been able to relieve them as soon as I thought they ought to be relieved. The patient I speak of is a little Indian woman of nervous temperament, with great vitality; she makes every effort to speak, but says it hurts her.

Dr. Mackenzie. I think we cure these cases more by psychical impression than anything else.

Dr. Logan. I would like to say that I tried that on my last case: I set a day for operation, and told the lady when the operation was performed I would have her speaking. I went down with a long forceps and played around in the larynx for awhile. She was very much wrought up about it. I knew I was not accomplishing anything, for I had nothing to accomplish. It made no such impression. When I have her go through the scale the ventricular bands do not move at all, but the cords act perfectly; the bands do not seem to obstruct the action of the cords at all. But the moment she loses sight of my constant effort to have her speak audibly the sound is but little above a whisper, and the ventricular bands approximate within two-thirds of their surface.

Dr. Price-Brown, Toronto. I would like to say a word in regard to the treatment of Dr. Ingals's cases. As I understand it, he places much more stress upon the importance of strychnine than menthol, but the point I wish to make is the possibility of the cumulative effect in giving strychnine in increasing doses for such a long period. I should be afraid to give it in that way and still have the spasmodic effect of the strychnine. I would like to have the experience of others on that point, because we might be inclined to give strychnine in increasing doses in neurotic cases, and it is a question with me whether it would be safe to do so. I think in this case the strychnine produced the cure and that the menthol did not have much to do with it.

Dr. E. Fletcher Ingals, Chicago. The question asked as to whether the case I reported was entirely hysterical I think was answered in the paper. There had been slight deafness before the fright; there was some thickening of the drum membrane. The suggestion that the length of time required to obtain relief threw some doubt upon the hysterical nature of the affection, reminds me that hysterical patients are not always cured promptly. I recall one case of hysterical aphonia that I treated for a year and a half before I succeeded in effecting a cure. She had been aphonic for five years before I saw her. I have seen many patients in whom the hysterical symptoms have not disappeared promptly that were cured by a few weeks of treatment I suggested placing reliance upon the sulphate of strychnine, which I use, and I am glad to speak of it again, because it is, to my mind, the most important remedy we possess in the treatment of hysterical aphonia, and it was

for that reason I gave it in hysterical deafness. It may be given with safety and benefit for a long time and in large quantities. I have given to various patients one-eighth of a grain four times a day for weeks, though I begin with about one-twenty-fourth of a grain and reach the large dose gradually. I do not expect to obtain any decided benefit from it until I get the muscles to twitching. I recently saw a patient who had been under my care two years ago for laryngitis, which appeared to be tubercular. After considerable improvement she went to her home in Iowa, and when she returned recently her larynx was practically normal, but she could not talk aloud, the aphonia being of only about two weeks' standing. I placed her upon the sulphate of strychnine, running up the dose to one-tenth of a grain four times a day before I obtained clonic contraction of the muscles. A day or two afterwards she had two or three convulsions, which were quite frightful to herself and friends, but which had the desired effect of restoring her voice. As to the danger in continued use of this drug, we may get what is called the cumulative effect, but I think there is no harm from it, so long as we increase the dose gradually and watch the patient. As soon as convulsive movements occur the dose is diminished or the remedy temporarily suspended. When a patient has once been brought fully under its influence we usually find that two-thirds of the dose that had been taken previously can not be borne afterwards. My rule is to gradually increase the dose until I get the toxic effects of the drug and then reduce the amount until it causes only slight twitching at times, and to continue this, if necessary, for three or four weeks. This remedy will accomplish more for the cure of hysterical aphonia than any other drug or method I have ever used. A question was raised regarding phonatory approximation of the ventricular bands. I am sure that they are closely approximated in some cases, for I well remember one in which it was impossible to see the tone cords during phonation because the ventricular bands always closed first.

ELECTRICAL ILLUMINATOR.

By Dr. D. BRYSON DELAVAN, of New York City.

I have been experimenting for several years with the view of evolving a convenient and practical electrical illuminator, and have here the product of that experimentation. It has been in use for a year and a half, and with success. The disadvantages of illumination by gas of course are obvious. The fact that gas evolves a large amount of heat and a certain amount of smoke and deleterious vapor, and that we are obliged to stay in our offices many hours each day and may thus suffer directly from its use, is a matter of common observation. It is desirable that electric light should be utilized, not only for the sake of health, but for the reason that in it we have a light that is manageable, the color of which is stable and uniform, and which in every respect is vastly more convenient than gas. The ordinary incandescent lamp with a single horseshoe loop, the ordinary loop filament, can not be adapted to our purpose by means of any mechanism I have been able to find. The objection to it is that the shadow or form of the loop filament is always in sight, no matter through how many series of reflectors it may be thrown. The reflection of the incandescent filament is dazzling to the eye as one looks into the laryngoscopic mirror, while the region in its neighborhood is in shadow. In order to adapt the light to our purposes it was necessary to make a new lamp and do away with the ordinary loop filaments. Many varieties of lamp were tried, the object of all being to concentrate the light as nearly as possible at one point, instead of distributing it through a long loop. The lamp finally selected is furnished with a single filament which has four convolutions,

the object being to collect a strong, uniform mass of light at one point. That mass of light, when the lamp is held horizontally, is distributed with fair uniformity in the lamp itself; not sufficiently so, however, to serve our purpose. In other words, if this light were to be thrown directly on the head mirror and reflected into the pharynx of a patient, it would be dazzling and uneven. In order to overcome this we throw between the light and the head mirror a small plano-convex lens, such as is used in the ordinary Mackenzie condenser. This materially distributes the light, takes away its dazzling properties, and causes it to be distributed pretty evenly over the surface of the reflector. In order to make the distribution of the rays perfect I used for some time a lamp with a ground-glass shade. This was expensive, however, about 30 per cent of the illuminating power being lost. Instead of this a plain lamp was substituted and the surface of the lens itself was ground. By this means a sufficient distribution of light is obtained to throw it evenly over the surface of the head mirror and to secure a perfect illumination from the latter. In short, a 40-candle-power Edison lamp with a peculiar filament is set horizontally in a hollow cylinder, the latter being merely a case to hold the lamp. The plano-convex lens is fastened to one end of the cylinder and the electric plug with the lamp to the other end. The current derived from the street is regulated by means of a common shut-off, the whole is mounted upon a suitable stand, and the apparatus is complete. I have used it in one form or another for the last two years, the last year and a half in the shape it is herewith presented, for all my examinations, and since using this particular 4-spiral filament lamp have had no difficulty whatever. One objection to the lamps of other varieties formerly used was that they quickly burned out. I have two lamps now which have been in constant use for over six months and which seem as good as ever, the lights having been in use several hours every day. The apparatus is made by the Edison Manufacturing Company, No. 110 East Twenty-third street, New York.

Dr. INGALS. I would ask whether the rays of light leaving the apparatus are divergent, parallel, or convergent?

Dr. DELAVAN. They are convergent.

REPORT UPON CASES OF TUBERCULAR LARYNGITIS TREATED IN COLORADO SPRINGS.

By S. EDWIN SOLLY, M. D.

I desire to report to you the general features and results of 45 cases of laryngeal tuberculosis treated by me in Colorado Springs, which place stands at an altitude of 6,000 feet. I have gathered together 250 cases of pulmonary tuberculosis, and the 45 cases are all of these in which there was unmistakable evidence of laryngeal tuberculosis. These 250 cases are not all the cases of pulmonary or laryngeal tuberculosis treated by me during the eighteen years of practice in this region, but are all that I had opportunity to follow out, and watch, and obtain such knowledge of as would enable me to speak definitely of their progress and results, and in order to allow a reasonable time to have elapsed before reporting I have taken no cases that were seen for the first time in the past two years and only those that were treated by me personally. As far as these conditions allowed the cases were taken as they happened to come and may be considered a fair sample of what the total of the cases would probably show if all the records had been complete, and this opinion as regards the whole 250 cases is confirmed by their similarity in quality and results to the cases reported by other observers treated in this and similar altitudes. I could obtain no reports of laryngeal cases alone to compare them with: as to results, reports of cures of laryngeal tuberculosis after treatment are reported,

but none that I knew of that have been any length of time under observation. It will be observed that in the duration of the disease there is a relative likeness to reports of cases in low climates as given by others and also a close resemblance in the percentage of laryngeal cases among the whole number of those with pulmonary tuberculosis, while the percentage in whom ulceration was found is close to that from Schroetter's autopsies though smaller than Willigk's or Mackenzie's. It is therefore, I believe, fair to infer that the cases are of an average quality, and this is shown by their resemblance to the reports of pulmonary tuberculosis treated at an altitude made by other observers. While these results could not have been obtained without treatment, yet in many of the cases similar treatment previously used in low climates failed of any such results.

Frequency of laryngeal tuberculosis among cases of phthisis.

	Larynx involved.		Laryngeal ulceration found.	
	Number of cases.	Per cent.	Number of cases.	Per cent.
Mackenzie	100	33	100	13
Louis	193	32.6		
Heinze	1,226	30.6		
Willigk autopsies			1,317	13.8
Schroetter			723	6
Solly	250	28	250	8

Twenty-five of the laryngeal cases showed clear signs of tubercular infiltration, which had not, however, proceeded to ulceration at the time of the first examination, though some of them did subsequently, while 20 cases had ulceration as well as infiltration when first seen.

The average duration of the nonulcerated cases from the date of their first symptoms up to the present time or death was 6 years, while of 17 of these cases who improved and are living the average duration is 13 years, and of the 8 who are worse or dead it was but 3 years 10 months. Total average duration of the 20 cases with ulceration was 3 years 2 months; of 5 cases that improved and are living it was 8 years 5 months; while of the fatal and deteriorated cases it was 2 years. Of the deteriorated cases, with and without ulceration combined, the average duration was 2 years and 7 months. This is somewhat longer than the 2-years' limit given by Bosworth for all laryngeal cases.

With regard to position of the ulcers, dividing them by the situation of the first or most marked ulcer, it was found upon the false cords in 20 per cent, on the commissure in 30 per cent, and upon the epiglottis in the same proportion; upon the arytenoids in 45 per cent and upon the true cords in 50 per cent.

Of the non-ulcerated cases 40 per cent were in the first stage, 32 per cent in the second, and 24 per cent in the third. Of those with ulceration 20 per cent were in the first stage, 30 per cent in the second, and 50 per cent in the third; thus showing a close relation between the condition of the lungs and throat.

The results are placed under the following heads: Cured, greatly improved, improved, and worse. These terms apply to the entire condition and not to the throat alone. The cured are those from whom all signs of ill health have disappeared and who have remained well not less than two years. The greatly improved are those who are practically well, but yet show some signs of trifling disability, or have not recovered long enough to be pronounced cured. The improved are those who, while they may have suffered and are still suffering from their battle with disease, yet show a tendency to recovery, but are still on uncertain ground. The worse include all the fatal cases and the few still living whose tendency is downward.

Seventy-eight non-laryngeal cases cured, 36 greatly improved, 30 improved, 57 worse.

Laryngeal cases.—Non-ulcerated: 9 cured, 7 greatly improved, 3 improved, 3 died, 2 worse. Ulcerated: 2 cured, 2 greatly improved, 1 improved, 10 died. Total laryngeal: Cured 11, greatly improved 9, improved 4, died 16, worse 2. Grouping together the cured, greatly improved, and improved, under the head of improved, we find of the whole 250 cases of phthisis 72 per cent improved. But of the 45 laryngeal cases only 49 per cent improved. The non-ulcerated cases, however, showed 68 per cent, and the ulcerated only 25 per cent improved. Taking the condition of the throat without regard to the ultimate fate of the patient, the results were much better, there being local permanent arrest of disease in 64 per cent, besides 5 cases which healed temporarily. Among the non-ulcerated cases, alone, 68 per cent showed a return to normal appearance in the larynx, while among the ulcerated cases, 50 per cent healed permanently and 3 cases, in addition, temporarily. With regard to the position of the ulceration the results were: Commissure, 33.3 per cent improved; true cords, 30 per cent; epiglottis, 17 per cent, while of the arytenoids and falss cords none improved. To recapitulate, it may be said that of the whole number of cases, viz., 250, a little more than 2 out of 3 improved. Of the 45 who had laryngeal disease, 1 out of 2 improved. Of the 25 cases in whom there was laryngeal tubercular infiltration without ulceration, a little more than 2 out of 3 improved, while of the 20 in whom there was laryngeal tubercular ulceration only 1 in 4 improved, but of the 205 cases without laryngeal disease there was improvement in nearly 3 out of every 4 cases, the exact reverse of the laryngeal ulcerated cases. This shows, as was to be expected, that the laryngeal complication reduces the chance of improvement, and when it has proceeded to ulceration does so to the extent of 3 to 1. But even then, according to the opinions expressed by laryngologists practicing in low climates, these are far better results than have been obtained, and shows, I believe, that similar beneficial, retarding, and often curative effects which have been demonstrated in pulmonary tuberculosis treated in Colorado and other high climates are exhibited in laryngeal tuberculosis. That the results are not quite as good, though relatively so, is of course to be expected, as in all of these cases, and I have never seen a laryngeal tuberculosis without an accompanying pulmonary tuberculosis; there was the double disease and therefore the double burden to bear. Moreover, there is little doubt that the laryngeal complication in almost all, if not in all cases, indicates a tendency to a free dissemination of tubercle and generally an absence of any self-limiting tendency. There are undoubtedly some cases in which the laryngeal tuberculosis is derived from a local inoculation from the sputum from the tuberculous lung lodging on the abraded mucous membrane, but clinical observation leads me to believe that in the great majority of the cases the infection starts from within and not from without.

Taking the results upon the laryngeal disease alone, irrespective of the ultimate recovery or deterioration of the patient on account of the accompanying lung disease, we find that in 64.2 per cent there was arrest, and if we consider also the five in whom there was temporary healing, which broke down again under the strain of the last weeks of fatal pulmonary suppuration, we see that the percentage of improvement in the local laryngeal symptoms is not very far short of that of the simple pulmonary cases.

While I believe that, contrary to what was a common impression, viz., that high climates are injurious *per se* to tubercular laryngitis, they are positively beneficial, speaking as a generality; yet such results as I report could not be reached without in the majority, especially in the ulcerated cases, of careful local treatment. As Bosworth truly writes, after advocating topical measures, "in no ulcerative process, probably, are we able to detect in a less degree any reparatory

effort on the part of nature than in tubercular ulceration," and yet instances of spontaneous cicatrization have been reported by Bouveret, Virchow, Jarvis, and others. With regard to the nature of the treatment, it must vary according to the appearance of the parts from day to day, and all routine treatment is wrong. But in speaking of general principles, it may be said that the first essential is the toilet of the throat; that is, the removal of mucus, pus, etc., and the washing of the membrane, and this is in most cases best procured and with the pleasantest effects by a free spraying with Dobell's solution. The old injunctions were to use sedatives and avoid stimulants to a tubercular larynx. Now, in the majority of cases if the choice lay only between sedation and stimulation, I would say stimulate, while there is, often continuously and generally at the onset, hyperæmia and hyperæsthesia of some of the parts, yet the underlying condition is an anæmic one, the congestions are chronic, not acute, and the real good of treatment almost invariably comes from stimulation ranging from the mild stimulation of weak menthol and nitrate of silver solutions, etc., to the cauterization with lactic acid, and the scraping with the curette of ulcerated surfaces. Cocaine should of course be used to avoid pain of treatment, while for pain at other times a spray of antipyrine will generally give a more prolonged relief.

I should extend this paper beyond its proper limit were I to enter further into the details of treatment, but I may mention that astringents, iodoform, etc., are often of service. I believe in using the cotton applicator, the powder blower, and the spray, as the case demands; also, I must mention the valuable aid I derived from the Sass inhaler, particularly with the use of benzoin inhalations.

To conclude, it may be said that the foregoing facts would indicate that while tubercular laryngitis is always a grave complication at an altitude, as elsewhere, and when advanced is almost invariably fatal, yet in the earlier and medium cases high climates, with appropriate treatment, afford relatively, though not actually, as good a chance of arrest or delay in laryngeal as in pulmonary tuberculosis.

CLINICAL NOTES OF CASES OF TUBERCULAR ULCERATION OF THE LARYNX, TREATED BY THE KRAUSE METHOD AT THE THROAT AND CHEST CLINIC OF THE EMERGENCY HOSPITAL.

By T. MORRIS MURRAY, M. D., of Washington, D. C.

In 1886, Professor Krause read his now famous paper before the laryngological subsection at the fifty-ninth meeting of German naturalists and physicians at Berlin, in which he asserted that, when great debility was not present, under which circumstances he always advised against the treatment, no tubercular ulceration with which lactic acid comes in direct contact refuses to heal. He reported 14 cases successfully treated in this manner. To Heryng, of Warsaw, belongs the distinction of having first employed effective surgical procedure in the treatment of tubercular ulceration of the larynx. In his book upon the surgical treatment of tubercular ulcerations of the larynx he reports 13 cases successfully treated in this manner alone. Krause has an article in the May number, 1889, of the Therapeutsche Monatschrift, in which he gives the history of 71 cases treated with lactic acid and the curette from 1885 to 1888, inclusive. Of these, up to the time of publication, 1889, 28 remained improved in condition, 7 dead, but not as a result of tubercular laryngitis, 8 the result unknown, 12 still under treatment, 8 sick when treatment was stopped, 8 died unhealed. At the Berlin congress in 1890 a day was given to the discussion of the treatment of laryngeal tuberculosis, and it was almost unanimously agreed that when properly treated with the curette and lactic-acid applications the disease was curable.

The literature upon this subject, particularly in the European journals, is voluminous. In America articles have been contributed by Delavan, Major, Weed, and others. One of the most recent publications is that of Dr. Hèlary, of Paris, in which he contrasts the medical with the surgical treatment of laryngeal tuberculosis. The conclusions at which he arrives are as follows: First. Laryngeal tuberculosis is not benefited by medical treatment. Second. Surgical treatment, on the other hand, ameliorates, in a certain way, dysphagia, dyspnœa, dysphonia. Third. Curetting the larynx causes the disappearance of the troubles of respiration and permits the avoidance of tracheotomy in certain forms of tuberculous laryngitis. Fourth. The extirpation of the infiltrated arytenoid masses has the most happy influence upon the dysphagia which it always calms. In permitting the patient to eat who is literally dying of hunger it prolongs his existence and contributes to the relief of the general condition. Fifth. Endolaryngeal operations are not followed, save in absolutely exceptional cases, by serious accident. Sixth. They have a happy action upon the ulterior evolution of the pulmonary tuberculosis, the progress of which seems to be retarded. Seventh. Surgical treatment does not act as a palliative merely; it can also, but in rare cases, cure laryngeal phthisis, as is proven by pathologic anatomy and in the clinic. Eighth. Curative treatment can be obtained in three ways: (1) By curetting the larynx, the more ordinary method; (2) by laryngo fissure, a procedure rarely employed; (3) extirpation of the larynx, an operation which has yielded one or two successes, but which must be rejected by reason of its too great gravity.

I have given these conclusions in full, because they embody so nearly the results of my own experience. I can not agree with him however if, as I understand him, he means to eliminate lactic acid in the treatment of tubercular ulcerations. I regard it as an indispensable aid in the treatment of many, if not most, of these lesions. Certainly this is true if the operations are done by any but the most skilled in such surgical procedure, and under such exceptional circumstances I think it has its value, producing coagulation upon the cut surfaces. It does away with reinfection from the pulmonary trouble, which nearly always exists in such cases.

In reporting the following cases treated under my direction at the Emergency Hospital of this city, I can claim nothing original in their management, scarcely anything of interest in their history. They are offered as a small contribution to the existing statistics.

Case 1.—A. S., white, female. Father healthy; mother died of throat trouble of four months' duration, and had cough before this developed; brother died at 16 of phthisis; sister living, asthmatic. Consulted me January 16, 1891. Had always been subject to colds, and in January, 1890, had grippe which lasted three weeks. A slight cough remained, from which she never entirely recovered. The following May the patient was treated by a laryngologist in this city for throat trouble and bronchitis. There was an ulcer which she could see upon left wall of pharynx; the epiglottis was said to be affected. In July she went to the country, and pharyngeal ulceration was healed in three weeks by application of sulphur. The summer was spent at Cape May. General health much improved; gained 7 or 8 pounds in weight. In September, had an attack of pleurisy which lasted for six weeks, and left her with a distressing cough. January 10, 1891, had pain for first time and difficulty in swallowing; no night sweats or hæmoptysis; no evening elevation of temperature. Appetite and digestion good; sleep disturbed by cough; menstruation normal; voice impaired. Examination of pharynx discovered an oval ulceration upon upper portion of the back wall, on the right; no indication of previous ulceration upon the left side; epiglottis immovable, indurated and much thickened; ulcerated nodules over whole of laryngeal surface; large ulceration on right ventricular band. Ary-epiglottic folds infiltrated; tubercule bacilli found in the pus from the pharynx and in the sputum; the apices of both lungs are consolidated and beginning to soften. Fifty per cent solution of lactic acid was applied to the pharyngeal and laryngeal ulcerations, which relieved the pain. February 22, the pharyngeal ulceration was curetted; application of lactic acid continued; the pharyngeal ulceration entirely healed in two weeks. The epiglottis and right ven-

tricular band were curetted March 22, and acid applied; the ventricular band cicatrized, but not the epiglottis; there was no pain on swallowing. In May she was very much exhausted by a profuse and painful menstruation, and was sent to the seashore for a week. Upon her return an ulceration was seen in the interarytenoid space. This was curetted, and the epiglottis the week following; the latter was permanently benefited, the former only temporarily so, and it was necessary to operate again June 17. Another confinement to the house greatly weakened the patient and the ulceration increased in extent and activity. Subsequent applications again held ulceration in check and relieved pain. The general exhaustion was increased by rapid softening of pulmonary deposits, and death ensued September 3, 1891.

Case 2.—James J. White, age 24. Family history good; has had a bad cough for two years; aphonia for six months; for two months has been spitting blood; is very much emaciated, hectic; painful deglutition; all of both lungs involved; cavity in the left lung; ary-aepiglottic folds and epiglottis infiltrated; ulceration of vocal cords and ventricular bands; large granulations in interarytenoid space. General treatment: Lactic acid applied to larynx, which relieved pain and lessened difficulty in swallowing; owing to extreme debility the patent was unable to come to hospital regularly. He was seen April 7; the uvula was then enlarged, of a firm and nodular appearance; this was amputated with snare and the base healed rapidly. May 7, superficial indolent ulceration on the left side of the soft palate; lactic acid applied. May 20, ulceration has spread; soft palate, dotted with small spots; whole palate edematous and infiltrated. June 12, soft palate a mass of broken-down nodular granulations, with tubercule bacilli in the pus; excruciating pain in swallowing; left side of palate curetted, followed by application of pure acid; relief so marked that the right side was treated in a similar manner and lactic acid applied every other day, until the ulcerations were entirely healed. Patient died July 10, 1891.

Case 3.—A. S., colored, widow, age 41. Family history good; had grippe in the winter of 1890; cough began to be troublesome in January, 1891; hoarseness supervened in March; no appreciable loss of flesh during the year and strength well preserved; the patient has an annoying cough at night; occasional night sweats; no hæmoptysis; painful and difficult deglutition; retraction of inferior clavicular region on left side, dullness of both sides; also broncho-vesicular respiration; occasional râles in both inferior clavicular regions, prolonged expiration in left; voice reduced to a whisper. Examination of the pharynx and larynx showed a large ulceration upon left side of posterior wall of the pharynx extending one-fourth inch above the level of the soft palate, palatine fold very much swollen and inflamed; ulceration in interarytenoid space and upon the right cord; ventricular bands thickened and very much inflamed; tubercule bacilli found in the pus from the pharyngeal ulceration and in the sputum. The patient was put upon general treatment and fuchsin applied to the larynx for two weeks. At the end of this time, the granulations having increased in size, it was replaced by a 50 per cent solution of lactic acid, applied twice a week. October 22 the pharyngeal ulceration was curetted and the acid applied. At the end of the week the tissue had again broken down. October 27 the whole of the pharyngeal involvement was again curetted and entirely healed in seven days and has given no trouble since. December 15, superficial ulceration appeared upon the superior surface of left arytenoid, and sudden increase in edema of the ventricular bands; treatment continued. January 5, ulceration upon the right cord healed; the ulceration in the interarytenoid space is the only active process remaining. January 13, application of acid continued. January 21, sudden edema and involvement of left ventricular band, margin of cord, and left arytenoid. February 25, ulceration of ventricular band and arytenoid cicatrized; left cord presents raw, lumpy granulations; treatment continued. March 31, no ulcerations visible in larynx; voice much improved; lungs in about the same condition as when first examined; general health improved and gain in weight; no evening fever. It is now eighteen months since the last operation. There has been no return of ulceration in the larynx. The normal weight has been regained and the patient is apparently in perfect health. The voice, however, is still impaired owing to what I think is an unusual accident in such cases. The vocal cords are united by a thick band of cicatricial tissue for nearly two-thirds of their entire length. This remains owing to a disinclination on the part of the patient to submit to the operation necessary for its relief.

Case 4.—S. C., female, colored, age 29. Examined April 25, 1891; pulmonary tuberculosis; deposits in the apices of both lungs; irregular granulations in the interarytenoid space; lactic acid, 50 per cent, was applied twice a week. There was a gradual disappearance of the granulations and cicatrization of the ulcer.

During the next month the patient failed rapidly. An ulceration was seen extending down the posterior wall below the cords. No return of the ulceration in the interarytenoid space. The patient discontinued her visits to the hospital, and, as I learned subsequently, died. In this case a severe edema, the only instance in my experience, followed one of the applications of lactic acid. It yielded, however, promptly to scarification.

Case 5.—White, male, age 56. First visit, May 6, 1893. Pulmonary and laryngeal tuberculosis with emaciation, anorexia, night sweats, etc.; both lungs were involved. There was a decided thickening and infiltration of the arytenoids and ulceration of the interarytenoid space. A superficial ulceration was also found on the upper edge of the left ventricular band. Lactic acid was applied twice a week from May 6 until June 3. Both ulcers were healed and there was a marked relief of the subjective symptoms. The patient's voice was strong and clear; general health improved. Last visit June 10.

Case 6.—White, female, age 29. First visit, June 26. Pulmonary phthisis; areas of softening in both lungs, with small cavities in right apex. There was an ulceration a quarter of an inch in diameter, with small granulations springing from its base, in the interarytenoid space. The voice weak and husky; deglutition painful. Patient was treated with lactic acid twice a week from June 26 to August 7. On the latter date the ulcer had cicatrized, the voice was clear, and the patient had no pain in the larynx. Last visit, August 7.

In three of these cases it can scarcely be claimed that life was much prolonged, but they were spared the terrible suffering always attendant upon this disease under former methods of treatment. In the third case I think it can fairly be claimed that the patient is cured. It will be observed that in cases 1 and 3 the laryngeal and pharyngeal ulcerations appeared practically at the same stage of the disease. In case 2 the involvement of the uvula and soft palate occurred when the patient was in the last stage of decline; yet in all the ulcerations which could be easily reached and thoroughly treated healed readily, while those in the larynx resisted treatment to a greater or less degree. These observations would seem to indicate that the limitations placed by Krause upon his treatment are unnecessary, and that desirable results in some cases can be obtained even though great debility should exist, whenever lactic acid can be brought in direct contact with the granulations. The management of laryngeal phthisis must always be attended with embarrassment to the laryngologist, owing to the extreme difficulty, if not impossibility, often, of reaching the whole of the diseased surface. With pharyngeal and buccal phthisis the case is different. There is now, I think, no reason why these most painful complications of tuberculosis, conducing, as they always do, to the speedy and fatal termination of the disease, should not be completely under the control of the physician.

PRELIMINARY NOTE ON THE USE OF THE FORMATES IN ULCERATION OF THE PHARYNGEAL AND LARYNGEAL MUCOUS MEMBRANE.

By E. L. SHURLY, of Detroit, Mich.

The caustic property of formic acid, whether derived from insects or plants or manufactured synthetically in the chemical laboratory, has for a long time been observed, and also antiseptic properties belonging to it have been noted from time to time, although the literature of the subject is very meager. Theorizing that this agent or its combinations as existing in animals and plants might be a natural chemical agent, in some way designed to protect their bodies from extraneous deleterious influences, it occurred to me to test the action of the various salts of formic acid upon some of the lower animals for the purpose of ascertaining their degree of usefulness in the treatment of general septic diseases, especially the so-called "tubercular diseases." Accordingly in 1891, in the laboratory of Harper Hospital, Dr. P. M. Hickey made formic acid from oxalic acid and glyc-

erin, according to the ordinary process; and directly from this made formate of sodium, formate of calcium, formate of ammonium, formate of barium, formate of copper, formate of iron, and the iodoformates of iron, sodium, calcium, and ammonium. We next tested the effects of these various salts upon such of the lower animals as mice, rats, guinea pigs, and monkeys. The formate and iodoformate of copper, sodium, calcium, barium, and iron were all found to be poisonous to mice and rats in the proportion of from one-half to 2 grains when introduced by hypodermic injections. They were also fatal, but after a longer lapse of time, when introduced into the stomach of these animals in somewhat larger doses. Rabbits and guinea pigs bore from 5 to 10 grains of formate of sodium, ammonium, and iron, but rapidly succumbed to the same dosage of the copper, calcium, and barium salts. The iodoformate of sodium was also borne in 5 to 10 grain doses by the larger animals. The iodoformate of sodium and ammonium proved to be antitoxic to pus and tubercular sputum in rabbits, as shown by the experiments of injecting these animals with each of these toxic materials, respectively, and then a short time afterwards injecting them with the above-named chemicals. One animal only, out of several, died from ordinary septicæmia. An extract of sputum, obtained by treatment with alcohol and phospho-molybdic acid, when injected into a mouse produced a convulsive chill, lasting until death, which occurred after eight hours. The same extract when mixed with an equal quantity of a 10 per cent solution of iodoformate of soda had no toxic effect. Pure cultures of the staphylococcus pyogenes aureus, when mixed with formate of soda and injected into the perioneal cavity of a rabbit, did not produce any toxic effect. Formate of sodium and ammonium only was given to monkeys by the mouth and by hypodermic injection. It was found that of all these salts formate of sodium and formate of ammonium especially were non-poisonous. A large-sized Rhesus monkey was given 60 grains, by the mouth, of formate of sodium in four doses, during a period of twelve hours, with the effect of reddening the tongue only, causing salivation and an inordinate appetite. From these preliminary investigations it was decided to turn our attention to the human subject, confining ourselves to the use of the salts of sodium, ammonium, and iron. Accordingly these were employed in hospital practice upon various patients, who were suffering from different forms of phthisis, especially laryngeal phthisis. These agents were also used upon a few patients who were suffering from epithelioma, lupus, and sarcoma of the throat.

One patient (Mrs. C.), who was suffering from general tuberculosis, was given ammonium formate in from 1 to 10 grain doses for over a period of two months, beginning October 28, 1891. It was administered to this woman, both hypodermically and by the mouth, from three to six times daily. Its effects were quite marked, being manifest occasionally by increase of appetite and extra salivation. After awhile its use would have to be discontinued on account of the supervention of stomatitis, but no sensible effect was observed on the general course of the disease. The hyperæmia of the buccal mucous membrane would soon subside upon the discontinuance of the drug. We also administered to this same patient the formate of iron with decided tonic effects, but its long continuance seemed to produce irritation of the intestinal tract. The same effect was observed from the use of the sodium formate.

Another patient (J. N.), suffering from severe tubercular ulceration of the larynx, was treated internally by the administration (as in the former case) of formate of sodium or ammonium, without very much effect upon the local lesion. Internal administration was stopped and the drug was used locally by means of spray and afterwards by insufflation, the insufflating powder consisting of sodium formate and starch, of each equal parts. Under the local treatment there was a marked cicatrization of the more recent ulceration, but among the deep ulcerations which

reached the cartilages of the larynx complete granulation and cicatrization could not be brought about. Notwithstanding this was a hopeless case, we observed that at the time of death the laryngeal ulceration was certainly one-half less than when he was "put upon" this local treatment. In a hopeless case of sarcoma (N. G.), where the ulceration of the pharynx was very extensive, formate of sodium was used by insufflation, and spraying three or four times daily for the purpose especially of testing its local action on such extensive ulcerated surfaces. To our surprise, even in this case we found that cicatrization of the superficial ulcerations here and there would take place in spite of the rapid breaking down of the tissues all about this region. Besides this, its effects were so marked in giving ease to the patient that he was constantly besieging the nurses to use it. These three cases cited were treated simply to test, under the most disadvantageous circumstances, the effects, if any, which these salts might have locally and not with any hope of producing permanent benefit. Deriving some encouragement from these observations, we have since used from 5 to 10 per cent solutions of the ammonium and sodium formates in a number of cases of laryngeal and pharyngeal ulceration of a specific, a tuberculous, and epitheliomatous nature. In the more benign cases cicatrization has promptly occurred from the use of these salts, although with many of them, through the unfavorable general progress of the disease, the effect has not been permanent. However, in purely benign ulcerations of mucous membrane these salts have been found very efficacious in producing healthy granulations and prompt cicatrization. It therefore seems to me that these agents are worthy of more extended trial in the treatment of pharyngeal and laryngeal ulcerations. The insufflation of equal parts of formate of sodium and starch seems to produce no direct irritation, unless used more frequently than about four times daily. In ulceration of the throat accompanying scarlet fever, and in diphtheria, formate of sodium or ammonium may be used by spraying or insufflation as often as once in two hours, without producing much if any irritation of the surrounding membrane.

I think formate of iron deserves a more extensive trial than it has had, for its good effects are certainly equal to some of the other salts of iron, especially in the septic diseases. The application of these salts undiluted to the mucous membrane (with the exception of copper) causes little or no pain. But a 10 per cent solution applied to the larynx, where the membrane is hyperæmic from recent disease, causes a stinging pain for a few minutes. But generally speaking, there is no smarting as a result of its application in the strength above indicated. However, in some instances where sodium or ammonium formate is applied directly to the mucous membrane it causes considerable sharp pain for a period of from five to ten minutes, but this is not the rule.

I do not consider it necessary to weary my hearers by lengthy details of all the cases in which these several salts have been used, because I think that further observation is requisite in order to place a proper value upon them as remedial agents.

DISCUSSION.

Dr. John N. Mackenzie, Baltimore. I have been very much pleased to hear these three papers. We now no longer regard laryngeal tuberculosis as a necessarily fatal disease; we are gradually getting to that position where we can tell a patient that in a case of moderate ulceration of the larynx, and especially of the pharynx, we can cure. I was very much interested to hear from Dr. Solly that these cases do so well in Colorado, and I am exceedingly glad to learn of his good results.

Dr. PRICE-BROWN, Toronto. I would like to say a word as to laryngeal operations in tuberculosis of the larynx, from my own limited experience. I have in one case, I think, seen a complete cure of infiltration with ulceration of the larynx by operative measures. Briefly, this case was that of a lady who came to me first in June, 1891. She was 27 years of age and unmarried. Her mother died of tuberculosis. She had been suffering from hoarseness for a year and a half and during the latter months of this time was almost completely aphonic; her temperature was 100°; she complained of soreness over the apex of the left lung. On examination I found solidification, bronchial breathing, and all the evidence of tuberculosis. Examination of the larynx revealed a large infiltration between the arytenoids with the ulcer projecting toward the epiglottis and extending to the level of the vocal cords. The cords were congested and she could not vocalize because it was impossible to bring them into juxtaposition. I applied a pretty strong solution of cocaine and made two operations with the galvano-cautery upon this growth, at an interval of a week. This did not have as much effect as I desired; there was some sloughing. During the summer of 1891 I curetted the growth a number of times. I did not use lactic acid, but what was much preferable to the patient, a solution of menthol in a strength of 5 to 10 per cent in albolene. This was used daily, and about the end of the year her voice had almost returned, the ulceration had ceased and showed cicatrization. I have seen her often since, and her voice is now entirely restored; there is complete healing of the ulceration; the lung is what I call fibrous, there is a creaking sound over it; there is no fever, but some cough. I saw her three weeks ago and her voice was clear. I think in this case there was complete cure by operation, but I suppose eventually she will die of tuberculosis of the lungs.

Dr. S. K. MERRICK, Baltimore. I am very glad indeed to hear of cases so near home as Washington being cured of tubercular laryngitis. One case in particular related by Dr. Murray, where he is sure the patient is well, I am particularly interested in; also the one to which Dr. Brown has referred. Personally I have never seen a case of laryngeal ulceration of tubercular origin that was cured. For some years there was a great deal of skepticism as to the possibility of such a result, but the cases have so multiplied and cases are so numerous it is now a notable fact that cases of tubercular laryngitis get well, temporarily, at least. It seems to me it is a distinct gain to know that we can do anything in these cases. I have a case of laryngeal ulceration that I saw this morning. When the case presented himself about six months ago there was simply slight swelling of the arytenoids, and there was a cavity in the right lung. The patient was sent to Atlantic City and he took on 12 pounds of flesh there in three weeks; still the throat trouble did not improve. He has been under treatment from time to time, and I have been sending him to the country a good deal. I believe to a certain extent, as Osler once said to me he believed, that "the country will do more for phthisis than any doctor can do." I believe that is certainly the case unless there are laryngeal complications. This patient spends most of the time in the country. All my cases of tubercular laryngitis go on and die. I have tried lactic acid and nearly every drug that has had a reputation for curing these cases. I may say that in the last twelve years I have had about 2,000 cases of pulmonary tuberculosis from outdoor clinics and I have never seen a case with tubercular laryngitis that has healed where there was the bacillus tuberculosis in the sputum, and I am very glad to find, so near home, gentlemen testifying to facts so favorable that are undoubtedly true. I feel utterly without hope in these cases when I take them. Any advance along the line of even temporary improvement is to be accepted with thanks, and it is to be hoped that reports will be even more favorable in the future as our knowledge increases.

Dr. H. Holbrook Curtis, New York City. I have been extremely interested in this discussion, especially in the remarks of Dr. Solly. I wonder if he realizes the weight of responsibility resting upon him in his peculiar position in the West and his great opportunity for observation in these cases. How excellent are the conditions when the patient goes to a mountain resort free from the cares of his business, where he is buoyed up by the enthusiasm and hope which must be more or less inculcated by association with the large number of patients who are improving. The statistics of his paper are very flattering and must of necessity be a little more favorable than the statistics we can show. It is very satisfactory to hear of any hope that can be given in cases of laryngeal tuberculosis. I reported four cases a year ago at the Academy of Medicine in which I thought three had made absolute recovery, but another year has passed and two of these cases have gone back; their throats have become reinfected, although they have been very careful in the use of peroxide of hydrogen and kept their throats very well cleansed. The one case I may still claim as a cure was a most peculiar one. This young man was 19 years of age. When he came to me his left lung was consolidated at the apex and his throat had the appearance of three Malaga grapes. The epiglottis was infiltrated and edematous, and both of arytenoids filled up the entire larynx so that I could only get an obscure view of one cord. I gave no hope whatever in this case; nevertheless, I scarified and curetted according to the method of Krause, applying lactic acid thoroughly, and to my surprise there seemed to be an improvement. As soon as the edema was reduced I saw that there was entire absence of the left vocal cord. When the throat got a little better he developed a perichondrial abscess, which I opened externally, and nearly one-half of the thyroid cartilage came through as a sequestrum and was removed. I kept a drainage tube there for nearly three months, when the ulceration of the throat entirely disappeared; afterwards the thyro-arytenoid muscle repaired itself and the vocal cord was reproduced as a flabby band on that side. That was eighteen months ago, and he has had no return of the throat trouble; but I am told that his other lung is affected and that he is running down and losing flesh from pulmonary tuberculosis. I do not think we ought to feel too much encouraged by the reports we have heard read, but we may hope to give patients suffering from this disease some relief. Two years is scarcely enough time in which to decide that these cases are cured. If we took five years our statistics of cure would be very much less. I think the return of the disease is almost inevitable. One per cent would seem to me a very flattering figure to place as the probability of cure in tubercular ulceration of the larynx.

Dr. D. Bryson Delavan, New York City. It is not often that three such papers are brought together at one time. Each is in itself extremely interesting, instructive, and valuable, the one to a remarkable degree offsetting the others, and each representing, as it does, a distinct basis of treatment. With regard to tubercular laryngitis there was formally no hopeful condition. Comparing the prognosis possible in many cases now, and I am not inclined to take a more sanguine view of recent advances than are others, in the last five years progress has certainly been made, although the fact remains that even before these new methods of treatment were proposed cases of tubercular laryngitis were known to recover. I have had several such, in which recovery was due to climatic influences of a favorable nature. Cases have also been seen, although very rarely, where tubercular ulceration has been arrested by persistent local treatment; I mean strictly therapeutic treatment. So there were two resources by which it was possible in rare instances to arrest tubercular laryngitis. When Prof. Krause and Theodore Heryng offered their suggestions a new field for research and experimentation was opened. Unexpected success attended their methods in that these patients did get well of tubercular laryngitis. That this is a fact I know, for I have seen

Dr. Krause take a case of advanced tubercular laryngitis in which it seemed that no help could be given the patient, and after performing what seemed to be a most severe operation have found that in forty-eight hours the patient was greatly relieved. I have operated upon cases myself where cicatrization has followed the removal of diseased tissue from the larynx and the standard treatment with lactic acid employed. Lactic acid is a good method of treatment, combined with curettement, or the extirpation of the diseased tissues. It is efficient in some cases where simple topical treatment would be unavailing. I had the privilege this winter of studying some cases under the care of my friend, Dr. Trudeau, in the Adirondacks, which showed very remarkable results in the healing of advanced laryngeal disease. I saw in the sanitarium at Saranac five cases in which advanced ulceration had been arrested. The treatment consisted of the injection of a modified tubercular lymph, prepared on a totally different principle from the lymph of Prof. Koch, and practically deprived of the irritating and dangerous qualities of the original tuberculin. Not only did these laryngeal cases do well under the injection of tuberculin, but cases of pulmonary tuberculosis have done well also. Since the date of the above observation, a period of ten months, all of the above cases have done well, and a number of new and successful ones have been added to the list. Each of these things marks an advance in the treatment of this disease, cases of which are so often set aside as incurable. It is immaterial whether the patient lives indefinitely or not; it is an immense advantage that he should be left to live out the time allowed him by his tubercular disease without tubercular laryngitis. If we can relieve the patient for a year, a month, or even a week, we are fully justified in bestowing all possible pains and labor in our power to help him. It is not necessary for patients who die ultimately from tubercular disease to have a recurrence of laryngeal symptoms. The reports of Prof. Krause show that a considerable number of his cases have been cured; that is, permanently relieved of laryngeal ulceration and all the attendant symptoms that go with it, although they have finally died of the pulmonary trouble. That is certainly a vastly better outlook than we had ten years ago, and it is certainly a subject of great rejoicing that we can relieve these patients, if only to a limited and very moderate degree. When it comes to the treatment of special cases, Dr. Murray has dealt with such as most of us will have to meet with, namely, those who must remain at home. Unfortunately tuberculosis is a disease which should be confined to the wealthy. The poor man ought not to have it. Unfortunately, he will have it, and we shall have to help him; and anything that will help him is greatly to be desired. We have the above resources, which can be carried out at home, to the great relief of the patient. The conditions described by Dr. Solly are truly, on the other hand, Utopian. They are the happiest, best, and most favorable conditions the tubercular patient can be placed in, namely, first, to be able to live in the most beneficial climate possible; and, second, in that climate to receive the most skillful and admirable treatment that can be given him. Under this second condition many of our health resorts are unavailable. We dare not send our patients to them, because there is no one there to look after them, and, if for no other reason, I think the writer of the paper deserves gratitude for the fact that he has been one of the pioneers in establishing the idea that a patient can be sent to a first-class climate and there receive first-class treatment. It is only a question of time when such sanitaria will become more widely distributed, and we can then select the climate most beneficial for a given subject. This experiment, carried out in Colorado Springs, is certainly one of the most interesting and valuable ever attempted in this or any other country. One word about the Krause treatment: While it may not be applicable in every instance, it certainly has a place in our armamentarium, and the successful work of every man in this direction is a benefit to us all. It would be very valuable if in discussing the matter with our patients we could

refer to such excellent work as we have just heard of, not only from one but from a large number of good operators and careful observers in this country.

Dr. E. Fletcher Ingals, Chicago. Years ago I stated at the American Laryngological Association that as a rule laryngeal tuberculosis would get better if the patient's general condition improved, but the reverse was also true. I think the rule is correct, but we have been shown to-day that there are a considerable number of exceptions, more than I had supposed possible. I was particularly struck with the remark that there seems to be something peculiar to the German people that enables them to bear severe treatment better than others, and perhaps the same may be true of negroes. My patients will not usually tolerate such rough handling, but certainly Dr. Murray's results were most excellent. I confess that after Dr. Delavan's report I had so little confidence in Krause's method that I did not try it, though I used the lactic acid without the curette. I did not fully understand whether Dr. Murray meant to fully coincide with the statements he quoted from Henry or not, but for fear he did not I want to say that I think they are not correct. For example, I understood him to say that laryngeal tuberculosis is not benefited by medical treatment. I am quite satisfied from a very considerable number of cases that medical treatment, even internal treatment, but particularly topical medical treatment is of very great advantage, and that many cases recover under this course; indeed, I believe many more than would be benefited by any surgical procedure. General treatment I consider of prime importance. Topical treatments have seemed to me of special value in relieving the sufferings of the patient and thus permitting better nutrition. Dr. Shurley, whose paper we have heard, sent me some of the formate of soda to try in laryngeal tuberculosis. I tried it in two or three cases, but not sufficiently to speak of its efficacy. I have used various other local remedies and have tried lactic acid, but have not used the latter thoroughly. Lately I have been using a remedy which at least in two cases seems to have been of very great value. In one of these cases the patient suffered from extensive tuberculosis of one lung. There were many tubercle bacilli in the sputum, but the larynx was not ulcerated, though both larynx and trachea were congested and there was some infiltration of the larynx. Under the influence of this remedy, the terchloride of iodine, he improved immediately, and his improvement was so great that the patient, who is a physician, calls himself well, though he occasionally catches cold and then comes in for treatment, one or two applications as a rule being sufficient to make him feel all right for a couple of months. I am satisfied that the terchloride should have the credit, for he says this is the only remedy that ever did him any good. The other case referred to was one in which there was extensive infiltration, and ulceration of the left ventricular band extending down to the cord. Under the use of the terchloride of iodine the infiltration has largely subsided, at least 50 per cent having disappeared, and the ulcer appears to be healed. There is a small excavation still, but it does not seem to be an open ulcer. The terchloride of iodine is specially valuable for the reason that when applied to a surface on which there is purulent secretion it becomes decomposed at once, the iodine being set free in a nascent state which is thought to be more than under other conditions. I use it in the strength of from 1 to 2½ grains to the ounce of distilled water as a spray. Dr. Curtis's remark that a patient must remain well from two to five years before he can say he is cured is very true, but if we can cause the ulcer to heal we do the patient a great good, even though a cure may not be effected.

Dr. Solly. I thank the section for the consideration they have given to my paper. What Dr. Curtis said about responsibility I think I feel very fully. One thing that particularly strikes me in regard to this disease and tuberculosis generally is that we have in Colorado Springs the opportunity of observing what may be termed its natural history. So many cases of tuberculosis die in low climates so

much earlier than in high, even the fatal cases are usually more prolonged in Colorado, and we have the opportunity of seeing the disease in its various phases, better perhaps than you do at sea level. Also, we are intimate with our patients, we observe them on the street, we know how they are living, what they are doing, and therefore there are many aspects of tuberculosis we see that do not show themselves to you. As regards the point of patients being buoyed up by the climate, that is true. Some are extremely hopeful when they come on the high ground. It has a marked effect upon perhaps 50 per cent, but on the other hand an equal number are homesick, suffering from the absence of friends and business; they are worried and fret and often die. Unquestionably two years is too short a time to pronounce any case cured, and in my reports no cases are given as cured in two years although some are reported as greatly improved. I have avoided using the term cured unless at least five years have passed, and in many cases longer than that; some observations go back seventeen or eighteen years. I could not burden the paper with fuller details of these cases, but I hope to publish them some time *in extenso.*

Dr. Curtis spoke about the return of the ulceration in the larynx. My statistics cover this point, but what astonished me very much, and Dr. Ingals also referred to it, is the fact that quite frequently when the patient was running down and dying of general tuberculosis the larynx remained healed. My observation has been when the ulceration is treated, getting down to what is called in the West "bedrock," there is seldom a return of ulceration in the same spots, though it may occur elsewhere if the patient's general condition deteriorates. Of course healing the throat is not necessarily curing the patient, but he is relieved from one of the most painful deaths, viz., that from tubercular laryngitis. A very interesting case illustrating the difference between healing and cure of the tuberculosis was that of a gentleman whose larynx is now in the Army Medical Museum. He was in the Navy and in good health until he was attacked with an acute laryngitis and bronchitis, which became tuberculous. Aphonia continued and a chronic laryngitis, but the bronchitis disappeared. He went on the Greely expedition and improved very much in the dry cold, got strong and vigorous, but his voice did not come back. On his return, finding himself running down, he went again on an Arctic expedition, with the same results, and so came to Colorado. He was brought to me for examination by another physician. His larynx was unquestionably tuberculous, but no ulceration was then visible, although there were some few papillomata on the commissure, looking as if an ulcer had healed. There was consolidation at the apex of one lung; he was somewhat affected constitutionally. I did not see him again for about six months. In the meantime he was running about the country and overtaxing himself, and was brought again to me complaining of soreness of the throat and continued aphonia. His physician then placed him in my hands for treatment. There were several ulcers, and one at the base of the epiglottis had perforated. Under radical treatment the ulcers healed, though signs of infiltration remained and the voice was but little improved, the dullness at the apex of the lung cleared up, and his general health became excellent. He started to drive from Colorado Springs to Kansas City in an open gig, and arrived East in fine condition. Dr. Solis-Cohen then examined his larynx and reported it healed. After six months' residence in Washington general tuberculosis of the peritoneum and meninges came on and fresh ulcers appeared in the larynx, though not in the old spots. This case shows that there may be very marked local results from treatment even when the general tuberculosis is not cured. It is possible had this patient remained in Colorado, as advised, that he might yet be living. However this may be, all my clinical experience warrants the belief that laryngeal is as well suited as pulmonary tuberculosis for treatment in high climates.

Dr. T. Morris Murray, Washington, D. C. It has been a great pleasure to me to listen to Dr. Solly's paper. The results of the treatment he gives there are by far the best published in this country, and suggest to me what I have thought was perhaps one of the reasons why we get such different opinions as to the value of these methods of treatment in tuberculosis; that is, that the climatic conditions under which the treatment is instituted influence very materially the result. As to the medical treatment of which Dr. Ingals speaks, I must confess that having carefully followed the history of the medical treatment of laryngeal tuberculosis it seems to me to be simply a record of disappointment and failure. I may possibly undervalue medical treatment in such cases: I refer to local treatment. While undoubtedly it has its advantages when combined with the removal of the cause of the disease, I think that time is wasted in their employment when it is possible with the curette and lactic acid to destroy the cause of the trouble. It is particularly gratifying to me to hear Dr. Delavan speak with enthusiasm upon the surgical treatment of laryngeal tuberculosis. This is so because he was the first in this country to call attention to the subject. His continued enthusiasm is a high tribute to the excellency of this method of treatment, which to me certainly appears far superior to any other heretofore suggested.

THE UTILITY OF THE ELECTRO-CAUTERY SNARE.

By HANAU W. LOEB, M. D., of St. Louis, Mo.

Since the introduction of the electro-cautery snare as an agent for removing neoplasms and hypertrophied tissues in the nose and throat three facts have been well established: (1) One may operate without the occurrence of hæmorrhage; (2) one may operate with greater celerity; (3) one may operate with more precision. The first of these stands without an argument; all must recognize the influence of the red-hot wire in staying the flow of blood. The second, while no less a fact, still admits of some discussion. For while there is no necessity for wasting time in removing an enlarged tonsil by a knife or a tonsillotome, if it is desired to be accurate in removal, in other words, if a certain portion is to be removed, the operation with a snare requires far less time. In removing polypi the most partisan advocate of the cold snare will admit that it consumes far more time than the electro cautery snare. But it is in reference to the last of this trinity of utilities that special stress should be laid, viz., the accuracy of removal. No one can hope, in face of the circumstances attendant upon pharyngeal operations, to be as accurate with the knife, scissors, or similar instruments as he can with the snare, which limits so exactly the line of removal. A patient may twist and turn as much as he pleases, and may indulge in gagging and the like, but when the snare has once been placed in proper position the operator may feel secure as to the amount of tissue he is going to remove. The cold snare is as accurate an instrument as the electro-cautery, but it does not rise to its plane of equality in so far as prevention of hæmorrhage and celerity are concerned. To consume half an hour in biting off a growth is by no means pleasant to the patient and is almost as annoying to the physician. There are other advantages of somewhat minor importance, such as greater ease of obtaining patient's consent to a simple operation, less pain, the decreased danger of injuring other organs and tissues, and the ability to perform two operations at the same time, where, under a form of operating without an absolute control of hæmorrhage, a second operation, on account of the flow of blood, would be precluded. The electro-cautery snare is therefore of utility in the following operations: (1) Removal of nasal polypi and tumors; (2) removal of redundant mucous membrane; (3) removal of tonsils; (4) removal of the uvula,

Removal of nasal polypi and tumors.—Among specialists the removal of polypi by the forceps has long since been tabooed and to the cold snare has been assigned the burden of popularity. As between the cold and the electro-cautery snare, there is to my mind no reason for hesitation in making a choice. The snare principle is the same in both, the manner of effecting the removal different. Tedious and failing to arrest hæmorrhage unless the wire be tightened very gradually, the cold snare is compelled to give way to the electro-cautery, which accomplishes the operation in an instant, occasions absolutely no hæmorrhage, and cauterizes the base of the tumor, thereby exercising an influence which in many cases at least prevents the return of the neoplasm. The application is as easy in one case as in the other, though until one is familiar with the electro-cautery instrument the wires attached to the handle may sometimes interfere. This objection, too, will be dismissed by a new handle which will not require the wires to be attached when applying the snare, a handle which I hope soon to have the pleasure of perfecting and of presenting to the profession. Far more polypi may be removed at one sitting. The act of removal in the one case requires but an instant, and in the other case from ten minutes to half an hour, depending upon the operator's other engagements. Less pain is occasioned by the electro-cautery snare, for the cocaine effect will not have worn away before the operation is completed. Farther application is accordingly obviated. After effects are no more common or severe than those following other methods of operating. This decision is the outcome of observation of a large number of cases during the past three years. During that time in over a hundred operations for nasal polypi no complication beyond the natural consequence of any surgical treatment has resulted, save in one case which was followed by otitis media, with which, however, I can not charge the electro-cautery. The operation was performed early in the morning of the 4th of July, 1893, and the patient carelessly stirred around all day, notwithstanding the inclement, damp weather. From this attack he very readily recovered. I do not wish to be understood as advocating the electro-cautery snare operation as a radical cure for polypi in opposition to the method of removing the diseased turbinate which primarily occasions the disease. I have too often seen the good effect of the latter operation. The fact still remains that the polypi are better removed by the electro-cautery snare; the other operation may, if indicated, be performed later. In all pendant nasal tumors, and in all those where it is possible to engage a wire around them, the electro-cautery is to be preferred to the cold snare, the reasons being the same as in the case of polypi, with a stronger argument in regard to its hemostatic power. Such tumors are often very vascular.

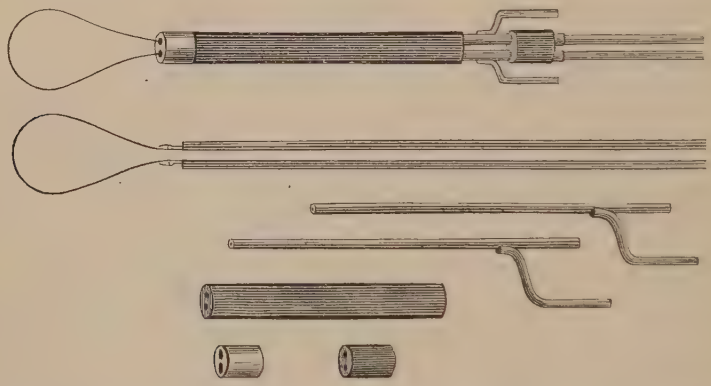
2. *Removal of redundant mucous membrane.*—In regard to the removal of redundant mucous membrane a similar condition of things prevails. As there is greater liability to hæmorrhage than in the case of polypi, the arguments urged before are multiplied. So kindly does the mucous membrane respond to this method of removal where it is indicated that I am safe in the conclusion that once tried it is sure to be adopted.

3. *Removal of tonsils.*—Tonsillar hæmorrhages are rare, but they are not so uncommon as to cause those who operate frequently to lose sight of their possibility. As the tonsillotome and the knife permit bleeding without restraint, it behooves the operator to lessen the chances if possible. The operation with a tonsillotome is too thoroughly ingrafted in the practice of the profession to expect a sudden change in the use of the instrument: it is too easy of performance to be cast to the wayside for what to many is an unknown quantity, and yet, after an experience not inconsiderable, I feel that my earliest expectations have been more than confirmed; truly no more thorough a realization could be desired. With the tonsillotome, in addition to the probability of hæmorrhage, no one can be very accurate; that is to say, the portion of tissue removed is apt to be greater or less

than was intended. When the electro-cautery snare, on the other hand, is used, precision is the rule, for the wire marks effectually the tissue desired to be removed. There is no danger of wounding the palate; no necessity of making a hit-or-miss thrust; no sudden action necessary on account of the restlessness of the patient; you may remove as much or as little as you wish. The method of operation is easy; the loop is placed around a pair of forceps, the tonsil is grasped by them, the loop engaged around the tonsils and tightened. The operation of removing adenoids may be performed coincidently with the tonsillotomy, as no hæmorrhage interferes with the administration of chloroform or ether: a point of no inconsiderable value.

It often happens that a moderately enlarged tonsil is quite impacted between the two pillars of the fauces. In such a case a small portion may be removed with the electro-cautery snare, which will afford a larger loss of tonsillar substance than simple cauterization.

Sequences are quite as exceptional as in other methods of tonsillotomy. In the 33 tonsil-removal operations performed last year by this method, no case presented anything beyond pain in the throat and occasionally slight pain in the ear. As is usual in most cases, a mild pharyngitis followed the operation. In one case, that of a young man of 18, otitis media followed eleven days after the operation, which was attended by no unusual symptoms, and hence, I think, not responsible for the otitis.



4. Removal of the uvula.—In the removal of the uvula the snare is convenient of application, the uvula being permitted to fall into the loop. The removal is soon accomplished, without any slipping, without pulling down the mucous membrane, and without more or less of the uvula removed than was intended. Of course, as in all electro-cautery snare operations, no hæmorrhage follows. The stump is more even and heals far more quickly. There is no such pain upon swallowing following this operation as after the cutting operations, and, with very few exceptions, patients were able to eat fairly well upon the day of and the day succeeding the removal, comparing very favorably to the after effects of operations performed with a knife, scissors, or uvulatome. Electro-cautery snares which have been in use are open to objections on account of their uncleanliness, on account of the length of wire necessary, and because of the occasional short-circuiting of the current. It is practicably impossible to perform anything like an aseptic operation with a snare of the old make, as when used a single time the discharges so collect upon the silk and cotton insulation as to render it unfit for subsequent use. The snare, however, which I had the honor of presenting before the laryngological section of the American Medical Association in 1892, and which I have been using for two years, negatives these objections. Every portion of the instrument is separable,

the canulæ, the copper wires, the ivory tip, and the rubber insulation. It therefore may be subjected to the ordinary aseptic procedures, the rubber insulation being in this respect far superior to the silk or cotton insulation.

By means of the two stout copper wires which are made to pass through the canulæ, and which are supplied with an eyelet in the upper end, a substantial loop may be made. I have of late used steel instead of platinum wire for the reason that it is firmer and more apt to remain where placed. It is not so lasting as the platinum, yet it has never failed to act. For every operation a new piece of wire should be used, as it becomes brittle after the current has passed through it. As the eyelets are very easily rethreaded, this is not a disadvantage.

Very valid objections have been urged against batteries of all kinds, whether primary or storage, and this condition of things has had no little to do with the non-adoption of the electro-cautery snare by many practitioners. The great progress of electrical inventions has come to our relief, for we now have appliances for changing the current used for lighting purposes so that it is available for the cautery. This supplies the missing link of electro-cautery possibilities, and makes those who use the electro-cautery snare secure in feeling that they have a medium of electric cauterization that is certain. I have during the past year been using for this purpose the converter made by the A. S. Aloe Instrument Company, of St. Louis, Mo., and I can testify that it has not failed me a single time.

Finally, and in all confidence, I beg to reïntroduce the three postulates of electro-cautery utility in nose and throat diseases, the three desirable ends in the removal of all non-osseous projections: (1) No hæmorrhage, (2) celerity of operation, and (3) precision.

SECTION XIV.—OTOLOGY.

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PROCEEDINGS.

ADDRESS BY THE PRESIDENT OF THE SECTION, C. M. HOBBY, M. D., IOWA CITY, IOWA.

GENTLEMEN OF THE OTOLOGICAL SECTION: In opening this otological section of the First Pan-American Medical Congress we can congratulate ourselves that, notwithstanding untoward obstacles, accidents by field and flood, and such financial stringency as perforce in many parts of our country prevents those that would greatly enjoy participating in this congress from obtaining for use their hard-won increment, long kept for this occasion, we have gathered together in sufficient numbers to assure the permanency of the body, and from a glance behind the veil I have no hesitation in saying that the character and quality of the papers to be presented guarantee for the First Pan-American Medical Congress a higher scientific value than has heretofore been obtained by any general medical assemblage on this Western continent.

The opportunity for interchange of opinions between the North and the South, the more than 100 of latitude that separates our confrères, the plains, table-lands, and the mountains of the tropics, suggest at once a multitude of questions that we of the North look to our brethren of the South for solution; but the story of the mucous membranes is a long one, and we hope that hereafter we may frequently share in similar opportunities for comparison. Meanwhile we have assurance of the kindly help of our fellows from the denser populations of Europe; and I congratulate you upon the presence with us of one whom we all reverence as a master; for whether we have been pupils at Vienna, or have through literature gleaned the steps by which otology has advanced since the days of Toynbee, there is not one of us but who acknowledges a debt of gratitude for the landmarks established by Prof. Adam Politzer; and I think I voice the universal sentiment of felicitation that his genius is still active, and that he is here to speak for himself. I have sampled some of the good things he has brought to you, and I assure you that it will hereafter rejoice you to have been present.

I shall detain you but a short time with the topic of my address, not because I do not profoundly believe that the methods of diminution of deaf-mutism are not among the most important considerations to come before you, for I do believe that in this case prevention must take the place of cure, but because I do not desire to encumber an address necessarily statistical with a flood of details. The material I have used, with the exceptions caused by death in the last eight years, is accessible to all for verification, and the facts are presented with the desire that you criticize the conclusions.

THE PREVENTION OF DEAF-MUTISM.

It has long seemed to me that in this era of preventive medicine, when our outer portals are so rigidly guarded against the admission of diseases like smallpox and yellow fever, which are easily recognized and quickly controlled at least in our Northern cities, that so little attention has been paid to an internal enemy whose permanency robs the State, the family, and civilization in a ten-fold ratio to the infections against which we so wisely and strenuously guard. It is an unfortunate, but undoubted fact, that census reports and governmental inspections in this country reveal only part of the truth. People feel that deformity, incompetency,

disease and the results of disease, carry with them a stain, a disgrace, and, if generally known, a discount upon the family importance which they desire to conceal. Especially is this true among the poor and uneducated, and the census enumerator does well if he gathers all the family names and ages and a small part of the truth in regard to the defective classes. In my own State, which probably contains the most prosperous agricultural population in the Union, without large cities, and with the most equal diffusion of education among all the States, I am satisfied that the census of 1880 gave less than 70 per cent of the number of blind or mute. This estimate is confirmed by Dr. Billings's comparison of the reports of deaths by the enumerators in Massachusetts and New Jersey compared with the State reports. This comparison showed that in 1880 the enumerators were deficient in Massachusetts to the extent of more than 26 per cent and in New Jersey to more than 34 per cent, and he remarked that "in no State is the deficiency in the enumerator's returns less than in Massachusetts." It is not probable that the enumerators were more accurate in regard to defective classes than they were in regard to mortality. We have no means of comparing the two enumerations for 1890, but as the ratio of 68 deaf mutes to the 100,000 population was maintained in 1890, we can say safely that the census report of 41,283 deaf mutes for 1890 represents an actual 50,000 or upward of this defective class. Taking the defective classes together we find that the proportion is as follows: Insane, 37 per cent; idiotic, 30 per cent; blind, 19 per cent; deaf-mutes, 14 per cent.

From the nature of the affliction public attention is seldom directed toward the mute. In his early years, no means of communication existing between him and the public, he is not noticed, and the lack of any external mark of his defect leaves him devoid of the sympathy that the people give to the blind. Later on, after he returns from the institution for education, he naturally fellowships with those who talk his language, and is only accidentally recognized by the public as one of the defective class. He is able to labor, to earn his own living, and usually succeeds in so doing; but without criticising the methods of instruction which are the results of the formulated experience of those who devote their lives to this noble work, with a few exceptions that surmount in an incomprehensible manner the barriers that exist, the great majority of mutes reach the age of 20, able only to converse with their fellows, and those that take the pains to acquire their language; but with such a limited range of tools of ideation as to make them unable to think or reason other than as a child of 10 or 12, or as a savage with small vocabulary, the mental action dwarfed, the enormous area of the incomprehensible that surrounds them when they reach out toward the public and converse with the slate, makes them seek their own kind for association and segregate them from the world. The mental incompetency so often manifested has in some of the States, I believe, been recognized as irresponsibility, and I believe that a large proportion of the 50,000 are as irresponsible for the results of emotional acts as are the insane or idiotic. While fostering every effort and every method that promises amelioration to this unfortunate class, I believe the duty of the medical profession goes further; that upon us rests a responsibility not met by simply using our influence to secure early training educationally, but which will only be accomplished when we shall have reduced to the minimum the number requiring such training.

Is any considerable proportion of deaf-mutism preventable? In considering how large a proportion can be so classed, we are met with a professional and popular opinion, which has so dominated the authors upon diseases of the ear that nearly all have contented themselves with accepting the statement of the teachers, that one-half of the mutes are "born deaf." A few have indicated that perhaps the proportion of congenital cases was overestimated, and it was without other preconceived opinion and against all that I had been taught that I was led,

after the examination of the admission papers of more than 1,000 cases, to go into a careful inquiry as to the basis of this general belief that at least one-half of the cases were congenitally deaf. After discovering that in former times, for educational purposes, teachers had classed all pupils that had never learned to talk as "born mute," and after finding that all cases in which the parents were unable to say when a child became deaf, or simply said, "He never seemed to understand what was said to him," that the case was almost invariably classed as congenital, I entered upon the investigation that led me to say in a paper on "Cerebro-spinal fever a cause of deafness," read before the Ninth International Medical Congress (Washington, 1887): "With a little care in sifting I have found out of 1,111 cases in Iowa only 13.3 per cent of congenital mutes, and I believe that a majority of those who have investigated the subject practically will agree that even this percentage is too large." Since that time a personal and careful examination of 250 cases, followed by correspondence, showed that only 14 per cent could have been born deaf, and the probability is strong that many of these cases have acquired the deafness in early infancy. The analogy existing between the causes of congenital deafness and pre-natal blindness would lead us to expect something like a parity in proportion; and the absence in statistics of congenital deafness of one ear points in the same direction. When we come to consider that the percentage of deaf mutes is only between 10 and 15 per cent, which is certainly true for the United States, we have left appealing to our art for relief 85 per cent of deaf mutes in whom disease of an active nature has played the devastating part in the early months and years of childhood. While simple middle-ear diseases unaccompanied by suppuration and consequent destruction of parts may produce deafness of so high a grade as to prevent the acquisition of vocal language, my examinations would limit the probability of this to less than 4 per cent. The destructive action of suppurative disease plays a more important part, reaching probably 10 per cent, and the remainder, nearly or quite 76 per cent, result from intra-cranial causes, and amongst these must be classed many attributed to scarlet fever, for less than half the cases following scarlet fever, examined by me, have shown marked lesions of the middle ear upon both sides. We hope that the diffusion of knowledge amongst general practitioners and the increased skill and thoroughness with which diseases of the nose and throat are managed by the profession at large will lead to more prompt and efficient treatment of such diseases when complicating the exanthemata, and so materially lessen destructive suppurative processes.

There still remain the great majority in whom intracranial, especially labyrinthine diseases produce deafness in the early months of life, and for whom there has seemed no hope. The study of these conditions is surrounded with great difficulty. Pathologically, the opportunity for close comparison of the clinical history with the morbid anatomy is extremely rare, and the recorded observations have hitherto given us little of value as to the relation between acute diseases and the development of extreme deafness. Clinically, we are met with the difficulty that only a small proportion of the cases are seen and studied by a medical attendant during the important period when deafness is acquired. A child of a few weeks or months is indisposed, fretful, its head is thrown back, it may decline nourishment, an eruption may, or may not exist, the symptoms pass away without any physician being called, and months may elapse before it is discovered that the child is deaf. Or the medical attendant being called, the disease recognized and recovery taking place to the gratification of the physician, the same delay exists between convalescence and the recognition of deafness; such occurrences are familiar to you all, and should lead to no censure of the attendant, for in the first place it is extremely difficult in infancy to determine whether the hearing is badly impaired or not, and we are not even certain whether the pathological cause of deafness is always or even usually developed synchronously with the acute affec-

tion causing it. The fact shown in my former paper that cerebro-spinal fever bears a causative relation to deaf-mutism, in the United States in from 30 per cent to 50 per cent of cases, is now well recognized, and while as a rule admission papers of institutions can be considered of as little except negative value, the exceptions in which the clinical history is developed by a careful medical attendant are sufficiently numerous to make certain that other febrile diseases, especially typhoid fever and mumps, are occasionally followed by deafness from internal lesion; and as indicated before, scarlet fever is a more frequent cause of internal ear deafness than of destructive middle ear disease.

Nothing in statistics or clinical history of the cases personally examined affords anything satisfactory in regard to the relationship of acute inflammations of the pia mater, "leptomeningitis infantum," "basilar meningitis," "purulent meningitis of the convexity," "traumatic meningitis," "consecutive meningitis," "metestatic meningitis," or possibly "tubercular meningitis," to lesions producing deafness; although we may believe that through these imperfectly known conditions the results are produced which are attributed to "rheumatism," "fright," "convulsions," "hydrocephalus," "colds," and the fevers generally. It is unfortunate that the term "epidemic" has been associated with cerebro-spinal fever, because on the part of the profession an erroneous idea has been developed. This disease is epidemic as typhoid fever is epidemic, under special circumstances, but like typhoid it is constantly endemic in all parts of the United States. Its prevalence as a scourge in special localities, and the undoubted fact that in malarial portions of the country many cases of cerebro-spinal fever were supposed to be remittent and other fevers, led to failure to appreciate this endemic character. However, it is in evidence that in Michigan there were reported, in 1873, 812 deaths, and in the ten years following a mean mortality from this cause of 178 per annum, the greatest number 330, the least 101, in a single year, and these cases scattered through the various counties and distributed through the twelve months so uniformly as to show conclusively for this State that the cases could all be considered sporadic. The same evidence is furnished wherever vital statistics are published in America. The occasional occurrence of epidemics in restricted localities among men and animals does not lessen the importance of the fact that this disease is always with us. Another important fact in this connection is developed by study of the census reports of 1880 and 1890, namely, that there exists a remarkable uniformity in the proportion of deaf-mutes to the total population North and South, East and West, through all the diversities of climate and elevation of this great country, and that the proportion remains nearly the same in the white and colored races; also that while scarlet fever produces its greatest ravages in the densely populated portions of the country and almost disappears as a causative agent in the production of deaf mutism in some of the States of the Mississippi Valley, we find cerebro-spinal fever producing an almost uniform rate of mortality in all parts of the country.

In thus presenting the conditions that must be met in efforts at prevention of the deafness of childhood, I wish to reiterate that the conclusions presented in the foregoing, differing in many respects from the accepted doctrines, have been arrived at only after careful clinical study of this helpless class, and I am sure the personal study of these cases in the institutions for education and careful sifting of the clinical histories of patients, with the assistance of those familiar with the incidents of early childhood of the victims, will lead to similar conclusions in any of the United States. Inherited syphilis, which had sparingly marked the features and teeth of those examined by me, will doubtless in institutions drawing from large cities appear more frequently, and the same is probably true of the effects of suppurative process, but I believe not to an extent to produce material change in the statistics of causation. It is apparent, therefore, that any considerable suc-

cess in diminishing the frequency of mutism must have its origin in the study of intra cranial diseases; the specific cause of cerebro-spinal fever remains to be discovered, and with a knowledge of the methods of infection and the reasons for its extensive dissemination the physician will be better prepared to study its natural history. To accomplish this desirable end it is necessary that the attention of the profession at large, the general practitioners of the whole country, be called to the frequency with which deafness follows apparently slight ailments of children, and impress strongly upon their minds further the fact that destruction of hearing most frequently takes place without symptoms referable to the ear. Through the public institutions a more accurate history of each individual could be obtained by correspondence with parents and medical attendants. The amount of energy that has been wasted in the endeavor to prove that deaf-mutism is largely the result of consanguineous marriages would be sufficient to greatly enlarge our knowledge as to the beginning of deaf-mutism. Public institutions can more readily than medical societies appeal to the public for coöperation, and through the public press awaken the people to one of the neglected results of infantile disease.

I am aware that much that I have said is an old story to most of you, but the strong impression made upon my mind by the conflict between the methods of causation as described in literature and the history of the cases studied in institutions, and the neglect of writers upon general medicine to afford to the general practitioner due warning of the dangers of the minor as well as the graver cerebral lesions, must be my excuse for appealing to you to investigate for yourselves these important questions, and I feel deeply grateful that I am enabled to make this appeal to those interested in the diseases of the ear from so many lands, representing all habitable latitudes.

PAPERS READ BEFORE THE SECTION.

OTACOUSTIC TREATMENT; ITS HISTORY AND RESULTS UPON THE DEAF AND DEAF MUTES.

By J. A. MALONEY, M. D., of Washington, D. C.

Prior to the year 1886 I devoted a great deal of time to experiment in physics and principally to its branch acoustics; the result of which was the development of the instrument since known as the otophone, which differed in construction from anything previously used for the purpose. It had three chief characteristics: (1) It did not enter the meatus auditorius externus; (2) it was a tube closed at one end by a flexible membrane, and thereby confined a column of air; (3) it was free from reverberation so common to the old forms. Its advantages reached the ears of Drs. S. Wier Mitchell and C. H. Burnett, of Philadelphia, and through them I was requested by the College of Physicians of that city to lay the matter before them and demonstrate its advantages. This was done on April 6, 1887. (See Transactions of the College of Physicians, third series, Vol. IX, Philadelphia, 1887.) Subsequently I was invited to make tests upon deaf mutes at the Pennsylvania Institution for the Deaf and Dumb and a confirmatory test at the National Deaf Mute College, Washington, D. C., and the results were laid before the American Otological Society, July 19, 1887, New London, Conn. (See Transactions American Otological Society, Vol. IV, Part I.) The cases so tested were classified as follows; (1) Five congenital cases; (2) five who lost hearing between the ages of 1 and 5; (3) five cases of profound hardness of hearing, being

educated as mutes, but who hear a little, can talk and understand lip reading, and may be termed "semi-mutes."

After the tests in Philadelphia (the first made), Dr. Burnett expressed surprise at the demonstration of the hearing power in the five congenitals. The results attending these experiments suggested the thought of a new field of treatment in chronic deafness, by means of passive motion, and I turned to physiological acoustics for light and knowledge, but found the path had been traversed only partially, until the portals of this domain of science had been opened by Weber, Lucac, Hemholtz, Politzer, Rieman, Henke, and in our own country by Blake, Burnett, and Sexton, and the literature upon the subject was sparse and not specialized. Up to this time otology depended upon local applications and "Politzer inflation." Then came Siegel's otoscope, as a means of passive motion, and later Delstanche's modification of same, but success in their use was rare, why? Because it produced a too violent and anti-periodic motion, and the ear of the lower as well as the higher order of animal shrinks from the same.

As before stated, prior to my discovery local treatment and Politzer inflation were the means most relied upon for success. The aurist in addressing himself to the external canal had light before him, as far as it related to that part. With Politzer inflation he could render the Eustachian tubes more patulous, and by so doing admit more air to the middle ear in an endeavor to bring about that important factor of audition, i. e., equalization of pressure upon each side of the membrana tympani; but should he succeed in getting a normal lumen established, any fixation of the transmitting mechanism prevented further success. This was the status of treatment in chronic deafness up to the year 1888, when I announced the discovery that sound, arbitrarily applied to meet conditions of each case, was a therapeutic agent of importance in chronic deafness.

The indications for scientific passive motion had long been suggested by the well known phenomenon of "paracusis Willisiana." Hearing better in a noise is an acuteness of audition made so by motion, but entirely different from the natural method for the following reason: Hearing better in a noise is a distinct function from that of normal hearing in that there is an antecedent momentum established by the noise through mass vibration, especially in a moving vehicle, and the voice as a superimposed vibration retards or interferes with the existing vibrations. This interference addresses itself to the sensorum as sound. In the normal ear the membrana tympani and ossicula auditus or transmitting mechanism has a direct action in the translation. Having completed the method and means for a system of aural massage, I designated it "otacoustic treatment," which covered in its meaning any sound to the ear. In my earlier cases I was struck by the relief afforded as well as the cessation of tinnitus aurium in many cases, and upon reflection I turned to my notes of experimentation, in which I tried to produce those sounds mechanically which are set out in my article "The sphenoid bone: some of its possible functions," (see New York Medical Journal, August 11, 1888). In speaking of tinnitus aurium, I said:

> I would here state that I have produced the singing sounds by getting a very loose contact in a Blake telephone transmitter, the contacts of which would be for the purpose analagous to the articulations of the malleus and incus, from which I have concluded that singing sounds are due to slight disarticulation of the malleo-incudal joint placed in vibration by some subjective cause, and continued by reason of the membrana tympani acting as a retractile spring, thus producing the same effect as the "Neff hammer" or make-and-break device upon the induction coil.

Much time was required in formulating the method of treatment in individual as well as classified cases during the first two years, the work being empirical because I had no rule of procedure based upon an experience by others for my guidance. That partial anchylosis or fixation of the ossicula auditus could be relaxed by this form of passive motion was accepted by some of the most eminent

otologists of our day, and I was encouraged by them to persevere. There were some, however, who ascribed my success to education of the perceptive tract, and this alone.

In the year 1890 I treated a patient, who was then dean of the Southern Homœpathic Medical College at Baltimore, Md. At the time of visit he was accompanied by a Dr. H. F. Garey, professor of otology in said college. Some time after this visit I understood that said Garey had applied the doctrine of "*similia similibus curantur*" to sound as a therapeutic agent, or, in other words, that the similar sound of tinnitus applied would cure the tinnitus as well as the deafness. Later on I was astonished to find in the lay press such announcements as "New way to cure deafness," "Deaf hear by phonograph, by Dr. H. F. Garey," "Sound waves in the treatment of aural diseases, by Dr. H. F. Garey." Whereupon I sent a protest to the faculty of said college against the unfair assumption upon the part of Garey; they in response indorsed his action.

This party used the phonograph and the similar sound (being a homœpath) as the tinnitus, but has since abandoned said instrument, as I did in my early experiments years ago. Others have since suggested the use of the telephone, but the use of phonograph and telephone for commercial purposes has produced ear troubles, in the latter case known as "telephone ear." They are frequently met with by otologists of our large cities. "Telephone ear" was first pointed out by Dr. Clarence J. Blake, before and during the year 1888 (see Transactions American Otological Society, Vol. IX, part 2, 1888) and later by M. Gelle abroad.

No man has used the phonograph more, nor had a greater opportunity of testing its efficiency in deafness than its inventor, Thomas A Edison, yet he has suffered for years from progressive deafness, and I was informed lately that he is profoundly deaf. The reason for the deleterious effect upon the ear from the use of these instrumentalities is the shock necessarily created by their sound-producing mechanism.

The method and means which I employ in otacoustic treatment are: (1) The tube or otophone hereinbefore mentioned closed at one end by a flexible membrane, and confining a column of air; (2) the method, which consists in the use of articulate sounds (preferably) by reading, twice or thrice daily for a given length of time, according to conditions of case; power of voice also being regulated.

Such is the history of sound in its application to otology up to this time. The diagnosis in profound deafness requires a knowledge of the history in each case and experience in the application of this method of treatment, based upon a familiarity with physiological acoustics. Strange as it may seem, otology, as taught to-day, ignores physiological acoustics, which, to my mind, is a *sine qua non* to that special branch of medicine and surgery.

I will now call your attention to the class of cases and degree of success obtained by otacoustic treatment:

Case 1.—Dr. B., a busy practitioner of this city, had three or four years previous, by diagnosis, Menière's disease. He applied to me for test May 4, 1887. Right ear only involved. He was very much surprised at being able to hear on that side. The next day I received a message, asking me to call at his office and repeat the test. After making the second test he apologized for being skeptical, and said that three of the most eminent otologists abroad had made an unfavorable prognosis in his case. The following day he commenced treatment, and on July 12 (two months afterwards) could hear unaided voice in a conversational tone a distance of 15 feet. He asked at this time what he could do to acknowledge the result, when I suggested that he communicate the facts to Dr. C. H. Burnett, of Philadelphia, which he did in a letter which was read at meeting of American Otological Society, New London, Conn., July 19, 1887.

Case 2.—Ralph G., æt. 12; February 12, 1887; diphtheria at 6 years. Before visit to me the boy had been treated in this country and abroad. R. E., destruction of membrana tympani, save a portion of membrana flaccida; ossicles absent; L. E., otitis purulenta; exacerbations frequent from exposure; pain relieved by discharge; membrana tympani perforated and sclerotic; inflammation with sup-

puration frequently recurring; slight naso-pharyngeal catarrh: excessive hypertrophy of tonsils (almost touching each other); loud voice: L. E. = 2 inches. R. E. = 0. Diagnosis had been made of paralysis of auditory nerve. The boy was an expert lip reader, and had the "deaf face" well developed. After examination I found after a five-minute test that he could hear, R. E., moderate tone at meatus, and range extended to 12 inches for L. E. I made a favorable prognosis for development of hearing to serve practical purposes through life. The usual local applications were used upon ears; naso-pharynx and tonsils and otacoustic treatment faithfully followed. On May 20, 1889 (a little over three months), the hearing power had been brought up as follows: With eyes closed could hear ordinary conversation at 12 feet, and this remained fixed up to time of last visit, August, 1889, his mother having removed to the far West: the deaf face had disappeared; he was ruddy and robust, and I think it would have puzzled an expert to discover that the boy had ever been profoundly deaf.

Case 3.—Mrs. W. H. H., æt. 46; June 1, 1889; atrophic nasal catarrh: R. E. deaf for fifteen years. W., R. E. = C., L. E. = $\frac{6}{60}$; B. C., good; M. T., sclerotic, opaque, retracted; tinnitus very persistent and varying; E. T. partly patulous. Patient was very skeptical of prognosis made after examination and tests, but her husband, who was present, urged her to proceed with treatment, which she reluctantly did. After thirty days the following results were shown: W., R. E., = $\frac{9}{60}$; L. E., $\frac{30}{60}$. Ordinary conversation heard in any part of room with back to speaker; tinnitus very much reduced. This patient was a neurotic and at the menopause. In November, 1890, she called to inform me that she had been ill with typhoid fever, but her hearing remained good. At this time tests showed: W., L. E. = $\frac{45}{60}$, R. E. = $\frac{16}{60}$; tinnitus scarcely perceptible, and then only at times.

Case 4.—February 15, 1889, Mr. J. Van S., æt. 36; lip reader: atrophic nasal catarrh. This case was sent by specialist, who was treating him for otorrhœa. Deaf R. E. three years, L. E. twenty-five years; had been under treatment for some years; W., R. E. = $\frac{1}{60}$, L. E. = C.; V., R. E. = 3 feet, L. E. meatus. After four months conditions were W., R. E. = $\frac{20}{60}$, L. E. = $\frac{6}{60}$; conversational tone of voice heard in any part of room (15 by 15) and low voice at 3 feet with L. E. The deaf face in this case was pronounced at time of first visit. On may 19 patient presented an improved appearance, no deaf face, and was bright and cheerful: V., undertone, 15 feet; W., R. E. = $\frac{40}{60}$, L. E. = $\frac{16}{60}$. On May 19 patient presented an improved appearance, no deaf face, a bright and cheerful countenance; V. = moderate, 15 feet; W., L. E. = $\frac{16}{60}$, R. E. = $\frac{40}{60}$.

Case 5.—Miss A. De L., æt. 24; January 16, 1890; expert lip reader; post-scarlatinal deafness since early childhood; R. E., W. = $\frac{9}{60}$, L. E., W. = $\frac{2}{60}$; B. C. good; chronic muco-purulent discharge from L. E.; M. T., R. E., opaque, retracted, and full of cicatrices, L. E., perforation in inferior posterior, quadrant and tissue bathed in muco-purulent secretion; E. T., R. closed, L. patulous; treatment for discharge of L. was carried out under otologist who sent the case. I directed otacoustic treatment to development of hearing in R. E. with disuse of L. E. because of sensitiveness (closing meatus with wool) for L. during medication. At end of thirty days, otacoustic treatment was used on both sides, the purulent discharge from L. having subsided. On May 8, 1890, conditions were, W., R. E. = $\frac{5}{60}$, L. E. = $\frac{25}{60}$. October 1, 1891, W., R. E. = $\frac{25}{60}$, L. E. = $\frac{26}{60}$.

Case 6.—Mrs. E. R., æt. 38; September 30, 1890, chronic naso-pharyngeal catarrh; M. T., L. E. opaque, thickened, retracted; E. T. partly patulous; M. T., R. E. opaque upon posterior segment, retracted; tinnitus aurium both sides; unfavorable prognosis by several specialists; had been under treatment for years; W., R. E. $\frac{6}{60}$, L. E. = O; B. C. good; V., R. E., loud = 6 feet, L. E., loud = meatus. October 30, tinnitus, R. E. seldom noticed, L. E. very much reduced; V., R. E. 10 feet, L. E. 10 inches. December 15 W., R. E. = $\frac{6}{60}$, L. E. = $\frac{4}{60}$; V., R. E., conversational tone, 15 feet, L. E., conversational tone, 4 feet. January 22, 1891, no tinnitus; W., R. E. $\frac{8}{60}$, L. E. $\frac{6}{60}$. May 4, R. E. $\frac{10}{60}$, L. E. $\frac{9}{60}$; V., conversational tone, R. E. 20 feet, L. E. 10 feet; no tinnitus. Upon first visit this patient stated "the deafness is of minor importance compared to the suffering endured from the tinnitus, and will be happy if rid of it within two years."

Case 7.—Mrs. G. B. This case was sent by specialist in another city, August 23, 1890; W., R. E. = $\frac{8}{60}$, L. E. = C. He reported under different dates as follows: November 19, 1890, "I have seen Mrs. B. but three times since she commenced your treatment. On November 13, she heard W., R. E. = 24 inches, L. E. = 4 inches; compared with R. E. 18 inches, L. E. = $\frac{1}{2}$ inch. October last, she is delighted, so am I." On February 20, 1891, she again reported, W., R. E. = 26 inches, L. E. = 12 inches.

Case 8.—Mrs. M. H., æt. 40; May 4, 1891; hypertrophic nasal catarrh; R. E., deaf six months, L. E., deaf eight years; M. T., R. slightly retracted, luster and trans-

parency somewhat diminished; L. retracted opaque; W., R. E. = C., L. E. = O; V. moderate, R. E. 6 feet, L. E. = O; no perception of quality, as patient expressed it, every sound was "whiz, whiz." June 2, W., R. E. = $\frac{4}{60}$, L. E. = $\frac{1}{60}$; V. mod., R. E. 10 feet, L. E. 4 feet. June 26, W., R. E. = $\frac{14}{60}$, L. E. = $\frac{10}{60}$; V. mod., R. E. = 14 feet, L. E. = 10 feet. October 10, W., R. E. = $\frac{24}{2}$, L. E. = $\frac{15}{60}$; V. mod., R. E. = 20 feet, L. E. = 17 feet.

Case 9.—Mr. W. G. P., æt. 25; November 27, 1891; atrophic nasal catarrh; lip reader; M. T., R. E. perforated, retracted, opaque, L. E., retracted, opaque. E. L., R. closed, L. partly patulous; W., R. E = $\frac{1}{60}$, L. E. $\frac{2}{60}$; V. Loud, R. E. = 12 inches, L. E. = 30 inches. December 24, W. E. $\frac{14}{60}$, L. E. = $\frac{20}{60}$; V. mod., R. E. = 6 feet, L. E. = 8 feet. January 21, W., R. E. = $\frac{24}{60}$, L. E. = $\frac{24}{60}$; V. low, R. E. = 10 feet, L. E. 10 feet. March 2, W., R. E. = $\frac{30}{60}$, L. E. $\frac{30}{60}$; V. mod., R. E. 16 feet, L. E. 13 feet. April 22, W., R. E. = $\frac{34}{60}$, L. E. $\frac{32}{60}$; V., R. E. = 18 feet, L. E. = 16 feet. This case was treated otherwise by aurist who sent case to me.

Case 10.—Miss H. R. B., æt. 28; January 4, 1892; lip reader; atrophic nasal catarrh, tinnitus aurium; M. T., R. E. retracted, L. E. retracted, opaque; E. T., R. patulous, L. partly patulous; W., R. E. = $\frac{3}{60}$, L. E. $\frac{1}{60}$; V., R. E. 16 inches, L. E. 3 inches mod. February 14, W., R. E. = $\frac{14}{60}$, L. E. $\frac{4}{60}$; V. mod., R. E. 5 feet, L. E. 2 feet. April 5, W., R. E. $\frac{16}{60}$, L. E. $\frac{6}{60}$; V. mod., R. E. 12 feet, L. E. 6 feet. May 7, W., R. E. = $\frac{24}{60}$, L. E. $\frac{15}{60}$; V. mod., R. E. = 26 feet, L. E. 20 feet; no tinnitus except slightly at period.

Case 11.—Miss K. M., æt. 32; February 18, 1892; atrophic nasal catarrh; M. T., R. E. retracted, cicatrix, opaque, L. E. retracted; E. T. partly patulous; W., R. E. = $\frac{2}{60}$, L. E. = $\frac{20}{60}$; V. mod., R. E. 24 inches, L. E. 4 feet. March 28, W., R. E. = $\frac{10}{60}$, L. E. $\frac{24}{60}$; V. mod., R. E. = 12 feet, L. E. 20 feet. May 9, W., R. E. $\frac{26}{60}$, L. E. $\frac{58}{60}$; V. mod., 15 feet, L. E. 30 feet.

Case 12.—Miss M. R., æt. 15; March 4, 1892; scarlatinal deafness; R. E. only; had been under treatment for years; W., R. E. = $\frac{3}{60}$; V., R. E. 12 inches, moderate; M. T., opaque, retracted; E. T., patulous. May 27, W., R. E. = $\frac{45}{60}$; V., R. E. 12 feet, moderate. June 15, W., R. E. $\frac{52}{60}$; V., R. E. 21 feet, moderate.

Case 13.—Mr. L. S., æt. 68; March 14, 1892; chronic atrophic catarrh; M. T., K. E., retracted, opaque, calcarious deposits, L. E. retracted, opaque deposits; E. T., partly patulous; V., R. E. = 12 inches, L. E. = 24 inches; W., R. E. $\frac{0}{60}$, L. E. $\frac{0}{60}$. April 27, W., R. E. = $\frac{4}{60}$, L. E. $\frac{12}{60}$; V., R. E. = 7 feet, L. E. 13 feet, moderate. May 27, W., R. E. = $\frac{10}{60}$, L. E. $\frac{25}{60}$; V., R. E. = 9 feet, L. E. 21 feet, moderate.

Case 14.—Katie J., æt. 8; June 1, 1889; scarlatina at 2 years; a good lip reader for one so young; profoundly deaf; no supposed hearing; articulation bad; M. T., R. retracted, parchment-like in appearance; L. better appearance; E. T., R. slightly patulous; L. patulous; diagnosis by several specialists paralysis of auditory nerve; after test, V. loud, R. E. = 0, V. loud, L. E. = 1 inch. As this was an out-of-town case the mother wrote after six months as follows: "I find it has been the means of great improvement in hearing and articulation." The father writing later to the physician who sent the case to me said: "We feel satisfied there is a marked improvement in her hearing; she now hears with both ears; she frequently asks, 'Which is my good ear?'"

Case 15.—Noma S., æt. 6; July 19, 1890; scarlatina at 5 years; W., R. E. $\frac{0}{60}$, L. E. $\frac{0}{60}$; V., R. E. loud, 5 feet; B. C. good; L. E. loud, 2 feet. September 16, 1890, W., R. E. = $\frac{10}{60}$, L. E. = $\frac{6}{60}$; V., R. E. 18 feet, moderate tone, L. E. 10 feet, moderate.

Case 16.—Miss C. P., æt. 22. February 12, 1889; supposed congenital; sent by a New York specialist for determination of hearing power. Had been educated as a deaf mute by the Bell visible-speech method. Upon examination I found hearing upon both sides, and after ten minutes she could repeat the test words naturally, conversation upon her part, owing to system of education, being in a monotone. For prognosis I gave improvement in audition sufficient for articulation. I heard nothing from this case until five months had elapsed, when the following report was sent from the person carrying out my instructions: "In less than a month 74 words and 40 sentences had been learned and were recognized upon day of review (end of month). At end of fifth month she had learned and could repeat many other words, besides figures up to 100." A physician residing in the city, becoming interested in the case, requested a test in his presence. He selected figures up to 100 as test. The teacher then selecting figures here and there within this limit called them to her and they were repeated without a mistake. Her mother could at this time, with unaided voice, pronounce a word close to meatus and her daughter would repeat it. This was the first time she ever heard her mother's voice. I have heard nothing from this case since directly, but understand it was laid before the American Association to Promote Teaching of Speech to the Deaf in New York, 1890. It was again referred to by the secretary of the said

association in an invitation for me to deliver a lecture before that body upon the cultivation of hearing at their June meeting, Lake George, N. Y., 1891. Said invitation I was forced to decline, owing to affliction in my family at that time.

Case 18.—Bessie B., æt. 16; January 10, 1891; scarlatina at 2 years. Her mother stated that an unfavorable prognosis had been made by several specialists. Owing to her mental condition she was at this time an inmate of an institution for feeble-minded children at Font Hill, near Ellicott City, Md. While conversing with the mother the girl sat looking at the ceiling, talking to herself and twirling her thumbs. She was very submissive to all tests, but would not allow examination by aural speculum, and never would. I found hearing upon both sides, and with fork test I found conduction *per aerial* and bone. F. C., *aerial*. R. E. $2''^{h}\,3''^{l}$, L. E. $2''^{h}\,3''^{l}$; V., R. E. 2 inches, L. E. 0 loud. I made prognosis for improvement of hearing sufficient to improve articulation if she was removed from her environment and taught at home.

Upon consultation with the father, subsequently, she was placed under my care. On February 21 the mother reported that her daughter called her attention to the blowing of a distant steam whistle while on the street. March 30 F. C., aerial, R. E. = $11''^{h}\,12''^{l}$, L. E. = $10''^{h}\,12''^{l}$; V., R. E. = 4 feet, L. E. = 2 feet.

Articulation much improved. Patient now left the city with her mother, and under date of July 28, 1891, the latter wrote: "Her health has very much improved, and the general comment of friends is that she has improved in hearing and speaking. I teach her regularly." November 12, 1892: "She has improved in articulation, and is being educated." At this date the hearing power was V., R. E. 6 feet, L. E. = 4 feet. I submit the foregoing cases as typical to show what can be done in many cases of profound deafness without the radical operation now so much in vogue.

DISCUSSION.

Dr. J. Mount Bleyer, New York. The phonograph undoubtedly can be used for the purpose of testing deafness as well as of curing such a malady. The trouble lies not in the phonograph but in the method of handling such an important technical instrument. Otacoustic method of treatment of deafness is the proper and only method of testing and aiding the treatment. Phonograms should be made in different acoustic grades. Tests by means of the phonograph are most reliable tests.

Prof. Politzer. Might I ask Dr. Maloney if he uses inflation with catheter in his cases?

Dr. Maloney. I will state that I am in the habit of using inflation after Prof. Politzer's method, and that I use the catheter only when absolutely necessary.

Dr. H. B. Young, Burlington, Iowa. Briefly I wish to add my indorsement to the views expressed by the president in his address. This has recently been added to by a consultation (case cited) in which an unrecognized sporadic cerebro-spinal fever in early infancy was undoubtedly the cause of the deaf-mutism found. The importance of bringing this matter to the consideration of general practitioners can not be overestimated as a prevention of deaf-mutism.

Dr. S. S. Bishop, Chicago. The showing made by Dr. Maloney is certainly a very favorable one. Respecting the use of the telephone and phonograph, I have never seen any good results to the hearing from their employment, while I have observed many cases of diseases of the ear apparently attributable to the use of the telephone. No cases of diseases of the ear resulting from the use of the phonograph have come under my treatment; but I do not believe it is in any way beneficial to hearing. In my clinics at the Illinois Charitable Eye and Ear Infirmary, Chicago, as well as in private practice, I have seen chronic non-suppurative inflammation of the middle ear, chronic suppurative inflammation of the same part, and ulceration of the auricle in persons who constantly use the telephone, either in the telephone offices or in large commercial houses, that I had every reason to believe were due to the irritating effects of the constant use of the telephone. However, I am not prepared to say that this instrument will cause ear disease in

those who are not predisposed to such trouble, or who have no preëxisting affection of the ear. The gentleman who was for a number of years superintendent of the Chicago Telephone Company, and whose hearing seemed to be normal, assured me that although he was in the habit of conversing many times a day by telephone no unpleasant results were experienced. I have also questioned quite a large number of people who constantly use the telephone, and who assure me that it produces no bad effect in their cases. But I believe its use by persons whose ears are diseased is positively injurious. The injury following its use may be due to the present imperfections in its construction which allow of the whirring and crackling noises that are irritating in character. If the uses of such i struments were beneficial to hearing, why should people become progressively deaf who are constantly subjected to the action of sound waves? They do nothing more than conduct sound waves to the ear. Notwithstanding the skepticism contained in this question, I shall give this instrument a fair trial if an opportunity is afforded.

Dr MALONEY. In reply to Dr. Bishop's remark that he did not see why persons should become progressively deaf while sound waves were constantly making impact upon the membrana tympani, it is clear to me why sound waves from unaided voice do not exert a beneficial influence in progressive deafness, because under conditions usually found in progressive deafness there is a resistance to transmission by ossicula auditus.

PATHOLOGICAL CONDITIONS FOLLOWING PIERCING OF THE LOBULES OF THE EAR.

By MAX THORNER, A. M., M. D.,

Professor of Clinical Laryngology and Otology, Cincinnati College of Medicine and Surgery Laryngologist and Aurist, Jewish Hospital; Consulting Laryngologist and Rhinologist, Ophthalmic Hospital, Cincinnati, Ohio.

The custom of piercing the lobules of the ear dates from the remotest historical antiquity, being first mentioned in the book of Genesis. It was practiced by the people of the Orient and by those of the West, and was transmitted from the races of classic antiquity through the middle ages down to our present times. Earrings were held among certain nations in high repute as talismans or amulets. They were, and I believe are still, superstitiously valued as remedies for eye affections. But their principal use was at all times, and certainly is now, that of ornaments to be worn, generally by women. And thus it happens that mothers, who who would otherwise protect their little ones from every harm and pain, will not shrink from subjecting them to an unnecessary, inexcusable, and painful procedure only to adorn them with the coveted jewel. This explains why such a barbaric custom as that of piercing the ears could have survived to our present times. It is, however, barbaric, not only because of its origin, nor on account of the crude methods by which it is practiced, but more so for the reason that not rarely more or less troublesome, and even fatal, consequences have been observed after this procedure. It is my pleasure to report to you to-day a number of such sequelæ of piercing the lobes, some of which seemed to me to be of more than ordinary interest, although there are scattered in literature a goodly number of interesting cases. Before reporting my own it may be opportune to mention a few of the observations made by others.

Hufeland saw a child die of trismus following piercing of the lobule of the ear.[1] Severe inflammation of the lobe, erysipelas of the ear, large granulations around the wound, cutting of the ring through the lobule, and hypertrophic thick scars

[1] Cited from Dieffenbach, Die operative Chirurgie, Vol. II, p. 78. 1848.

are some of the possible sequelæ mentioned by Dieffenbach.[1] Fibroids (keloids) have been observed by many authors and are mentioned by Knapp, Agnew, Turnbull, Finley, Bürkner, Schwartze, Politzer, Bacon, and others. They occur up to the size of chicken eggs, and are said to be more common among the colored than the white race. Politzer says[2] they are benign, no recurrence taking place after total extirpation. He refers, however, to the case of Agnew,[3] in which a tumor originating in a traumatic scar returned again and again. And, according to some observers, recurrence of these tumors is not at all uncommon. Knapp has called special attention to the fact that they are liable to recur, and that by frequent recurrence they may become malignant.[4] And in all cases of tumors of the auricle to be reported in this paper recurrence has taken place several times. Sexton[5] speaks of a cleft lobule from earrings, and saw even a portion of the lobule slough off. Kirchner[6] says that the lobule is not infrequently the seat of an eczema, originating by preference in the pierced holes. Altschul has reported a death from gangrene following piercing the lobes in a girl of 9 months:[7] and erysipelas, sometimes fatal, is mentioned recently by Haug[8] as being occasionally caused by the reprehensible practice of piercing the lobule.

It would be easy to multiply these cases, but these will be sufficient to show that there are abundant observations on record to make one reflect why the voices of physicians or at least of otologists are not raised against this "truly barbarous custom," as Roosa calls it. The following cases have come under my observation:

ERYSIPELAS OF THE AURICLE AND FACE.

Case 1.—The lobule was pierced in a child 2 years old, and this was followed by a severe attack of erysipelas, involving the whole auricle, auditory canal, and part of the neck.

Case 2.—A lady 20 years of age, who had not worn ear-rings for some time, was, on attempting to do so again, obliged to use some force in placing them. Pain, redness, and swelling soon developed in one ear, and the erysipelatous inflammation also involved face and scalp.

Case 3.—Also in an adult, and very similar to case 2. In this case the general symptoms were very severe, and the erysipelas, after having spread over the face and neck, invaded the pharynx. The patient recovered.

DÉFORMITIES.

Two cases of cleft lobule were seen, caused by the ear-rings cutting through the lobe. In the one case both lobules were torn. The clefts were readily repaired by the operation advocated by Knapp,[9] by paring the edges and stitching the little flap left on the posterior lip over the corresponding portion of the anterior lip, thus avoiding a notch in the lobule. The result of the operation was good. The other case of cleft lobe was peculiar. It was that of a middle-aged woman, in whom the earring had torn through the left lobule about ten years ago. Two years later she got tired of wearing but one earring, and she had the left lobule again pierced close to the old aperture. In the course of time this ring had also torn through, parallel to the old slit, and the woman had now a lobule consisting of three pendants. The narrow central strip was removed, and the edges of the remaining parts united in the above-described manner. The cosmetic effect was good.

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[1] J. F. Dieffenbach. Op. cit.

[2] Lehrb. d. Ohrenheilkunde. 1882, II Bd., p. 720.

[3] Trans. Amer. Otol. Soc. 1882, p. 720.

[4] Quoted by E. B. Dench, in Burnett's System of Diseases of the Ear, Nose, and Throat. Phila., 1893, Vol. I, p. 157.

[5] The Ear and its Diseases. N. Y., 1888, p. 112.

[6] Schwartze's Handb. d. Ohrenheilk. 1893, Vol. II, p. 18.

[7] Ibid.

[8] Arch. f. Ohrenhlk. Bd. 35, p. 142.

[9] Archiv. of Ophth. and Otol., Vol. III, No. 1.

One case of enlargement of the opening made for earrings presented a peculiar and even ridiculous appearance. The hole on one side had gradually enlarged, from the weight of the ring, to the size of a lead pencil, and repair was desired by the patient, a young lady of 19 years, for cosmetic purposes. The edges were pared with a cataract knife, united by one suture, and healed readily. (A similar case is described by Roosa.[1])

ECZEMA OF THE AURICLE.

This has been observed in a number of cases to be caused by the wearing of earrings, especially when they had accidentally caused small tears of the cutis, and also after forcible placing of earrings, when the opening had been closed for some time. It was generally the acute form which was seen, causing swelling, excoriation, formation of unsightly crusts, and bleeding, often upon the slightest touch. This form is, as a rule, very painful. Removal of the cause, and treatment with ointments (for instance the Ung. Diachylon) were sufficient to produce a speedy cure. In two cases the eczema had reached the chronic stage, in one involving the larger part of the auricle, and more especially the furrow along the insertion of the auricle. These cases were more obstinate, but yielded also finally to treatment.

TUMORS OF THE AURICLE.

Case 1. Fibroma (fibro-chondroma) of auricle.—The patient, referred to me in August, 1887, by Dr. Wright, was an unmarried lady, 32 years of age, white. Had been troubled as a child with painful swellings of both lobules, which caused her to discontinue wearing earrings at the age of 17. At the age of 22 she noticed that the old swelling in the right lobule, which had been pierced higher than is the custom, and very close to the antitragus, began to grow, until it had reached the size of a small cherry. Two years thereafter it was removed, but showed signs of recurrence within a year. Three years ago, and five years after the first operation, it was again removed, but began soon to reäppear, until it had reached the size of a small chestnut, involving the whole lobus. Removal was effected by a V-shaped excision, and the edges brought together by sutures. The tumor had not returned two years after the operation, the last time I saw the patient. The microscope showed, within a dense connective tissue formation, the structural elements of cartilage sparingly interspersed. A case of fibro-chondroma of this region has also been reported by Strawbridge.[2] The appearance of cartilage in a tumor of the lobule finds its explanation in the fact that the lobule is not entirely free of cartilage. There is, as W. His[3] has shown, an uniform strip of cartilage below the antitragus called lingua auriculæ, which is the cartilaginous support of the lobule of the auricle.

Case 2. Fibroma of the auricle.—For the history of the following interesting case and the specimen I herewith present to you, I am indebted to my friend, Dr. O. Landman, of Toledo, Ohio. Mrs. C. E. J., white, æt. 35. When 15 years old her earrings were caught on a pillow and both forcibly torn out. The wound healed, but later on a "lump began to grow" on both lobules. Two years afterwards both lobules were partially amputated. The left tumor has never returned. The tumor in the right ear returned six times, and reached an operable size about every three years. There were six operations after the first. Two years ago Dr. Landman saw the case for the first time, when the tumor had reached the size of an English walnut, involving the larger part of the auricle. He operated by amputating the entire auricle. About eight weeks ago the lady was seen again. There were at that time no signs of recurrence. The microscopic examination showed the tumor to be a characteristic fibroma, containing possibly a little more yellow elastic tissue than is usual in this kind of tumors, but which might be expected from the structures involved.

Case 3. Keloid of the auricle and face.—Miss E. P. H., of Indiana, white, 35 years old, was seen one year ago. When 18 years old a small nodule developed in the right lobule, close to the puncture. This began to grow, was painful, and was excised. Within the following seventeen years the recurrence of this tumor was

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[1] A Practical Treatise on the Diseases of the Ear. New York, seventh edition, 1891, p. 104.

[2] Trans. of the Amer. Otolog. Soc. 1875.

[3] Arch. f. Anat. u. Physiol. 1889, v and vi.

the cause of untold misery for the sensitive woman. In the course of time she was operated upon six times with the knife, and caustics of every description and in untold quantities had again and again been used. Electrolysis and hypodermic medication had been tried in vain. The pain produced by these different therapeutic agencies, especially the caustics, and the frequently unbearable pain within the growth had undermined her health. When I saw her, a little over one year ago, there was a solid sessile tumor, the size of about a silver quarter, extending from the region below the tragus into the cheek. The lobule and lower posterior half of the auricle were gone, and from the edge of the rest of the auricle a dense and unyielding cicatricial tissue extended into the integument below and behind the ear. The tumor was flat, about one-sixteenth of an inch elevated above the surrounding skin, ordinarily pale, and not sensitive to the touch. At the time of menstruation it was usually congested, and slightly more elevated, and caused, especially at such times, but occasionally also during the intervening period, the most intense and lancinating pain. The tumor was removed by an elliptical incision in healthy tissues, care being taken to lift it with a portion of the subcutaneous adipose tissue from its location. After severing, by deep incisions, some of the cicatricial bands behind and below the tumor, I was enabled to close the wound by sutures. Primary union. There remained a thin linear scar, the pain disappeared within a few weeks, and there have been no signs of recurrence as yet, fourteen months after the operation. On former occasions the tumor showed signs of reappearance within six months. The microscopic examination made by Prof. Kramer, of the Cincinnati College of Medicine and Surgery, showed the removed tumor to be a true keloid. The epidermis was atrophied, and hairs, hair follicles, and glands were entirely absent. The Malpighian layer was distinctly preserved, but there were only scanty traces of papillæ. Immediately below them, and arranged in layers parallel to the surface, there was a dense mass of fibrous tissue, in which here and there blood vessels, some compressed, appeared. Among the bundles of fibrous tissue occasionally elastic fibers were noticed, and also frequently groups of spindle cells. Below this was a looser connective tissue, with many cellular elements, and a gradual merging into adipose tissue. Of course it is too early as yet to say whether the last removal will be followed by a recurrence. It is true that most authors insist upon the possibility, and even probability, of a return of these growths after operation. But no treatment has as yet been devised that will actually give better results; while Erichsen,[1] though admitting their liability to return after excision, calls this their only treatment. And in this case, the almost intolerable sufferings of the patient, whose best years had been sacrificed in the battle with this baneful disfiguration, compelled me to do something that gave her at least a slight chance of a permanent cure.

These cases do not demonstrate anything new, but having occurred under my own observation lead me to believe that they are still more frequent than we usually think; and while in most cases no serious consequences result from the folly of piercing the ear lobes, yet there occur from time to time cases where a life is at stake or where the enjoyment of life is seriously interfered with. It is time that this relic of barbarism ought to be relegated where it belongs, to the bygone follies of superstition and fashion. And the day is, I hope, not far distant when it will be considered an evidence of brutality to have a tender and unprotected child subjected to such an unnecessary and mutilating procedure.

DISCUSSION.

Dr. C. R. Holmes. I have seen three cases in colored women, which, however, were not operated upon. A fourth case, occurring in a white woman 20 years of age, was operated upon four years ago. The tumor occurred on the left side and was about the size of a large hazelnut. It was removed by a V-shaped incision, healing by first intention. There is no recurrence up to date.

Prof. A. Politzer. I desire to ask Dr. Thorner how many cases of tumor of the auricle, all told, have been seen by him; whether they were all produced by ear-rings, and whether there were any colored people among his patients?

[1] The Science and Art of Surgery, Vol. II, p. 314.

Dr. THORNER. The total number of cases of tumors of the auricle seen by me is four. But only in the three reported by me the history of the patients left no doubt that the piercing of the lobe was responsible for the affection. The fourth patient was seen but once and, refusing any operation, was lost from observation. Although these tumors seem to be much more common among the colored race it was strange that all the patients referred to were white.

ON A PECULIAR AFFECTION OF THE LABYRINTHINE CAPSULE AS A FREQUENT CAUSE OF DEAFNESS.

By Prof. ADAM POLITZER, M. D., University of Vienna.

The subject of the writer's paper is a peculiar form of deafness, occurring usually in the aged and due to a pathological alteration of the labyrinth capsule. During the examination of a number of temporal bones of people who had suffered from progressive deafness, the author remarked circumscribed bony protuberances in the neighborhood of the niche of the fenestra ovalis. These protuberances were of the size of a lentil, rather flattened toward the edges, and contrasted with the surrounding parts by their yellowish color. The mucous membrane of the tympanic cavity was generally normal, occasionally somewhat thickened. The fenestra ovalis was, in some specimens, of normal appearance, in others narrowed by protuberances. The stapes was usually immovable; yet, in very few specimens, slightly movable.

In the second edition of the author's text-book on Diseases of the Ear, published in 1887, may be found a drawing of a case of bony anchylosis of the stapes. Besides changes in the stapedio-vestibular articulation, the capsule of the labyrinth shows considerable enlargement of the lacunar medullary spaces. These changes were interpreted by the author, as well as by others who had observed similar conditions, as being due to chronic interstitial middle-ear catarrh. The study of the specimens which the author demonstrated to the section showed that this view is not correct, and that these cases which have usually been grouped under dry, sclerotic middle-ear catarrh, are in reality due to a primary lesion in the capsule of the labyrinth.

The following are the histological changes observed in the microscopical sections made from the specimens: The parts surrounding the oval window are transformed into a uniform mass of newly formed osseous tissue. The normal articulations between the stapes and oval window have entirely disappeared. The plate of the stapes is frequently thickened, even to five or six times the normal size. The ossificatory changes begin in the bony labyrinth capsule and extend toward the oval window and the plate of the stapes, sometimes even toward the cochlea and the vestibulum. Sometimes the ossificatory changes only produce partial ossification of the stapedio-vestibular articulation, so that in the same section we find one portion of the articulation completely ossified and another still membranous. This partial anchylosis explains why the hearing power for a loud voice is still retained in some cases. The newly formed osseous tissue stains more deeply with carmine, and this difference in color enables us to distinguish the pathological tissue from the normal, even with the naked eye. The number of bone corpuscles is usually increased, the lacunar and medullary spaces are generally larger and contain fibrillar tissue, cells, blood-vessels, osteoblasts, and osteoclasts. It may be well to assume that the changes are due to a primary inflammatory process in the labyrinth capsule, producing a formation of new and young osseous tissue, which successively replaces the normal bone, and by extension toward the stapes and other contiguous parts finally causes the important functional changes due to anchylosis of the stapes. These conditions represent one form of progressive deaf-

ness. That other pathological conditions, entirely different in character, caused by chronic middle-ear catarrh, such as calcifications and ossifications of the stapedio-vestibular ligament, or adhesions between the branches of the stapes and the lower wall of the niche of the oval window may, and do often, produce similar clinical symptoms is a well-established fact. Very little could be ascertained regarding the etiology of this form of progressive deafness, as the disease was observed in old people from whom it was impossible to obtain an accurate history. In two cases gout may be assumed as a possible cause. That syphilis undoubtedly may cause such conditions may be assumed from the investigations made by Moos, who found hyperostotic changes on the labyrinthine wall of the tympanic cavity.

[Specimens and drawings were exhibited and explained by the author, illustrating the conditions described.]

In conclusion the writer refers also to the practical bearing of his investigations; inasmuch as these conditions demonstrate to us why our therapeutic efforts are not always crowned with success. An operation can only afford possibilities of success provided the affection in question has not yet caused anchylosis; and that, even should an operation in some cases bring immediate relief, a permanent result can hardly be expected if the anatomical changes which were exhibited in the specimens are only considered, inasmuch as the affection is progressive, and even the extraction of the stapes would not prevent an obliteration of the oval window.

ON THE APPLICATION OF STACKE'S METHOD IN CHRONIC AURAL CATARRH.

By FELIX COHN, M. D., of New York.

The results obtained by the method usually employed in the excision of the ossicles have not been very encouraging, so that the author attempted the application of Stacke's method of operation, which he calls "extra-auricular," in contradistinction to the ordinary method, the "intra-auricular," in these cases. Although no cases of its application in chronic aural catarrh have been as yet reported, *a priori*, this method appeared to have considerable advantages over the usual method, chiefly in that the regeneration of the drum membrane might be prevented if the entire tympanum and the limbus be removed; that the external wall of the attic being removed, a larger area for the impact of sound waves on the stapes and the oval window is provided; that the intra-auricular method does not permit of thorough asepsis; and that, finally, the field of operation being larger the successful removal of the ossicles is in all cases certain. As the operation was experimental in both cases only one ear was operated upon. Two cases are reported.

Case 1.—Man, aged 21, operated November 21, 1892, on left ear; suffered from severe tinnitus aurium and progressive deafness. On left ear conversation in low voice not at all audible; loud whisper, 1 inch. Six weeks after operation tinnitus entirely disappeared in operated ear; ordinary conversation, 3 feet; loud voice, 8 feet.

Case 2.—Girl, aged 16, suffering from sclerosis and of the anchylosis stapes; operated December 15, on left ear. On examination, hears loud voice at 1 foot; immediately after operation hears ordinary conversation at 1½ feet; loud voice, 8 feet. Six weeks later, hearing is reduced to condition before operation.

The author does not claim any wide applicability of this operation, or the extra-auricular method, in the present state of our knowledge of chronic aural catarrh. Though the success of the experiment has not been brilliant, it has, however, demonstrated the perfect safety of this method, and its availability in cases in which the intra-auricular method is not practicable. With improvement in diagnosis and careful selection of cases, the author believes that better results will be obtainable by Stacke's method than by the intra-auricular method.

OPENING THE MASTOID CELLS IN ACUTE INFLAMMATORY MIDDLE-EAR DISEASES.

By L. D. BROSE, M. D., PH. D.,

Oculist and Aurist, St. Mary's Hospital, Evansville, Ind.

Although the indications as laid down in the text-books for opening the mastoid cells in acute inflammatory middle-ear diseases seem well defined, it has nevertheless been my experience to have met with cases where mastoid swelling and edema were present associated with pain and fever and other symptoms, usually indicative of mastoid cellular involvement, where, owing to failure to obtain consent of the patient to an operation or through other causes, delay was encountered, the patients eventually made a perfect recovery under simply local treatment. Dr. Knapp, of New York, seems to have had a similar experience, for in a recent report[1] of a so-called case of "Bezold mastoiditis with operations," he states that he is afraid at the present day there is too great a tendency to opening the mastoid and the skull, and that precision in the determination when to or when not to operate can only be obtained by a critical comparison of many fatal cases. As an exploratory operation, he thinks mastotomy not yet harmless enough to be justifiable in many cases. To more minutely bring up the symtomatology of the subject and describe a method of operation, I will relate several of the cases which, in my opinion, justified opening the mastoid cells.

Mr. J. E., 41 years old, came to me early in July, 1891, with right-sided otorrhœa, accompanied by pain in the temple and frontal region. The disease was of ten days duration, and previous to this time he had never had ear trouble. By gentle syringing with warm water the external auditory canal was freed from pus, showing slight edema and swelling of its walls and middle-ear pulsation. Pressure over the tragus and mastoid region elicited soreness, but little or no pain. Treatment, three Swedish leeches in front of the ear, hot-water instillations of fifteen minutes duration, frequently repeated, and later insufflations of dry powdered boric acid. July 26, otorrhœa cured and patient passed from under observation, complaining still of nocturnal pain. In the following October he had an attack of meningitis, for which he was treated by Dr. A. M. Owen, and finally resumed his business, that of shoe merchant, in December. During the meningeal attack the ear pains returned in severity, but unaccompanied with otorrhœa. Patient continued to complain of earache off and on, and finally again consulted me in March, 1892. At this time there was neither swelling nor tenderness in front of or back of the ear. The drum perforation in the lower and posterior quadrant was almost wholly closed, with the hearing of ordinary conversation fairly good. April 14, consent was obtained, and after shaving the scalp around the ear region and carefully washing the side of the head with a 5 per cent solution of carbolic acid, an incision was carried down to the bone just upon a line with the ear insertion some 2 inches in length. Strong retractors were inserted and the wound widely separated. The bleeding, which was light, yielded to compression. With hammer and chisels a funnel-shaped opening was made into the temporal bone upon a line with the upper border of the external hearing canal and parallel to its axis down to the mastoid cells, and a small quantity of pus liberated. The operation, which had not required more than ten minutes, was terminated by packing iodoform gauze into the wound and placing over this a pad of absorbent cotton moistened in sublimate water and a retaining bandage. After the third day the dressings were renewed almost daily until the patient's complete recovery and discharge, May 24, 1892.

Mr. A. De F., 71 years old and a practicing physician, came to see me about April 20, 1892, for profuse left-sided otorrhœa, attended with violent pains all over the side of the head. His history was that he went outdoors the last Sunday in March, 1892, a cold, raw day, without a hat or head covering, from which he took severe cold in the head, followed during the night with earache. For several years previous to this he had been hard of hearing in the right ear through dry chronic middle-ear catarrh, which in turn followed chronic naso-pharyngeal catarrh, with which for years he has been afflicted. The present otorrhœa set in five days after

[1] Archives Otology, July 9, 1892.

the earache, mitigating but little this terrible pain, for the relief of which he has been daily resorting to powerful narcotics. The region in front of the tragus was swollen and tender and the patient was much annoyed by a "slushing" in the external auditory canal when he moved the jaws in speaking or eating. The discharge from the ear was ropy, very copious, without odor, and the canal lumen so encroached upon by its swollen walls that little could be seen of the drumhead. The mastoid region was not swollen, but tender upon firm pressure. Treatment, hot-water instillations, followed by a 10 per cent solution of cocaine when there was severe pain and large doses of chloral hydrate at bedtime. No improvement resulting, three Swedish leeches were applied over the tragus, followed by Leiter cold-water ear coil. During the flow of very cold water the pain would almost cease, only to gradually return with increased severity after its discontinuance. The patient, because of his age, was loath to take an anæsthetic and have the mastoid cells opened. Finally, June 2, he consented, and after the usual antiseptic preparation of the field of operation, a long incision along the line of ear insertion was made, the mastoid cavity opened with chisels, considerable pus evacuated, and a communication reëstablished with the middle ear and through the Eustachian tube with the pharynx. After each irrigation with a weak solution of sublimate water, fluid invariably entered the throat. The pain became less, narcotics which had been used for two and one-half months were dispensed with, and recovery slowly followed. July 6, 1892, he returned to his home, the perforation in the drum membrane healed and hearing restored to ordinary conversation.

Amos W., 28 years old and a farmer, came November 5, 1892, with a history of having used cold salt water as a snuff in the September previous for the cure of chronic catarrh. In a few days left-sided earache resulted, followed by an ear discharge of bloody serum, which later became purulent. He was treated in a neighboring village and cured by boric-acid insufflations of the otorrhœa, but thereupon followed an edematous swelling back of the ear, with at times return of the ear pain. An ointment of mercury and belladonna was prescribed, with frequent poulticing. During the next two months the swelling back of the ear would decrease and again increase, with at times slight otorrhœa. December 6, 1892, mastotomy was performed in the manner described in the preceding cases, and a small quantity of pus found in the mastoid cells. Result, recovery in seven weeks, with hearing improved to watch at 2 feet.

In reviewing the indications which lead one to determine whether a mastotomy should or should not be performed in a case of acute middle-ear disease, I can not too strongly advise against permitting the presence or absence of any one symptom to determine the point in every and each instance, but rather to make a study of each individual case in all of its symptomatology, with proper consideration of the result of recognized good previous treatment. Schwartze says,[1] at the furthest, after eight days of antiphlogistic treatment, especially ice applications, if the pain, edema, and fever have not ameliorated, the operation is indicated. Further along, though he qualifies this positive assertion somewhat, and says that while in most cases unbearable and uncontrollable pain in the mastoid region, radiating from thence into the head region around, urge one to operation, they are, nevertheless, and to a high degree, uncertain in determining suppuration in the mastoid. Redness, edematous swelling, and marked tenderness over the bone on pressure may be due to localized periostitis, not in anyway connected with middle-ear inflammation. The most reliable symptom of acute suppurative mastoiditis, in his opinion, is stenosis of the external auditory canal through swelling and bulging of the posterior and upper wall, with edematous skin inflammation just below the apex of the mastoid process. Deep-seated furunculosis of the external auditory canal, however, must be excluded.

In the course of acute purulent otitis media without involvement of the mastoid and without retention of secretion, Dr. Heimann, of Warsaw,[2] thinks mastotomy indicated if the otorrhœa remains profuse and does not yield after a certain time (two or three weeks) to the usual methods of treatment. Where ear drainage, after perforation of the drum membrane through swelling of the mucous lining of the middle ear or great stenosis of the external auditory canal, is insufficient,

[1] Second volume Handbuch der Ohrenheilkunde, 1893.

[2] Archives Otology, Vol. xx, No. 2.

the operation may be indicated as a prophylactic measure, in the prevention of death through imperfect disinfection. Cerebral abscess, brought about by acute, suppurative, middle-ear disease necessitates opening of the mastoid, for without it the termination is invariably rupture into the ventricles, or fatal meningitis. We suspect this condition through pressure symptoms on some of the cranial nerves, speech disturbances, or by ophthalmoscopic eye examination disclosing changes in the eye ground and vessels, with or without irregular fever, chills, delirium, stupor, drowsiness, and coma. Suppurative phlebitis with thrombosis of the lateral sinus as well as extradural suppuration are in many cases not distinguishable from deeper-seated abscesses and call for operative treatment as well, even if septic or pyæmic symptoms have occurred. When the thrombosed jugular vein can be felt as a hard, painful cord along the sterno-cleido-mastoid muscle, we have all the more reason to suspect involvement of the sinus, but it should not be forgotten that the vein accompanying the lymphatic plexus may, through inflammation, likewise occasion this tenderness when the sinus and internal jugular are perfectly healthy. Persistent headache, nausea, vomiting, and dizziness, with diminished, otorrhœa, may signify meningitis. Still the boundary between meningeal irritation superinduced by the middle-ear inflammation and meningitis proper is not at all sharply defined and calls for the exercise at times of unusually clear judgment. Repeated and obstinate attacks of mastoid neuralgic pains, unassociated with fever, or even loss of hearing, and which resist antineuralgic treatment, can at times be alone cured by mastoid resection.

The region for a mastotomy operation may be defined as just under the linea temporalis, above and just back of the posterior wall of the external auditory canal in front; a layer of bone from one-sixteenth to one-eighth of an inch thick usually separating the mastoid antrum and the inner end of the bony external auditory canal. Following Hartmann, of Berlin, my first incision is from 1½ to 2 inches long and just back of the insertion of the ear muscle, with the center corresponding to the upper edge of the external auditory canal. After thoroughly scraping away the periosteum a funnel-shaped canal is carefully chiseled out of the temporal bone, layer by layer, in a direction inward and forward and parallel to the axis of the auditory canal. Frequent examination with head mirror, ear speculum, and, when in doubt, the ear sound in addition, keep me informed as to the depth of penetration as well as its course. When pus is reached, and there has been no reason for suspecting extensive bone involvement, the operation is terminated with the removal of just enough bone to give good drainage. For more extensive suppuration and where the attic is largely the seat of the disease the posterior wall of the inner end of the auditory canal may likewise be removed and a drainage tube at times carried through the new-formed opening and out of the external meatus. Iodoform gauze keeps the wound open and serves as a dressing next to the bone, and over this a layer of absorbent cotton and a bandage is placed. Good results, however, can be obtained in many cases equally well with drill, chisel, or trephine, more depending upon the operator and his anatomical acquaintance with the neighboring blood vessels, nerves, and cranial contents, with careful and well-regulated after treatment, than upon the instruments with which the operation is performed.

CHRONIC DISEASE OF THE MIDDLE EAR: ITS PROGNOSIS AND SURGICAL TREATMENT.

By ALBERT H. TUTTLE, S. B., M. D., of Cambridge, Mass.

The treatment of the chronic dry form of aural catarrh has always been an unsolved problem with the profession, and even to-day adequate means for its prevention or cure are unknown. It was with the hope of relieving the deafness

resulting from this disease, sclerosis of the tympanum, that Schwartze, for the first time, removed the membrana tympani and malleus in 1873, and by his precedence encouraged others to undertake similar operations. Soon after Schwartze, Kessel took up the subject, and did much to establish the operation. He removed all the ossicles and insisted that good results in hearing could only be expected when the stapes was removed. In 1880 Weber-Liel reported a case of dizziness, following a destruction of the stapes, with loss of labyrinthine fluid. Bishop operated 14 times by simply removing a small piece from the membrana tympani in 1885. In 1886 Rossi in 2 cases disarticulated the stapes from the incus, and Sexton introduced the operation of removal of the larger ossicles and membrana tympani in certain cases of persistent suppuration of the middle ear. In 1887 Baracz removed the membrana tympani and larger ossicles for tinnitus aurium, and the following year Burnett performed the operation for a similar purpose. In 1888 Berthold while operating on the middle ear accidently removed the stapes complete and observed as the result a great improvement in hearing. The cases which were operated upon by removing membrana tympani and ossicles now began to increase rapidly in number; Stacke reported 10 cases and Sexton 29, treated for chronic suppuration of the middle ear in this manner, and soon after 28 cases were reported by Wetzel, 32 by Ludwig, and 20 by Colles; Schwartze, in two and one-half years, operated on 151 cases; Milligan reported the results of 4 operations. During these later years the operation became limited almost exclusively to cases of chronic suppuration, and it was not until the last (1892) that the operation, in modified form, was revived for its earlier indication, the relief of chronic deafness by Jack, who operated for the simple removal of the stapes. Since then the latter operation has been performed by Blake, Burnett, and others. As to the result of these manifold operations, deafness has been greatly relieved in many cases, in others slightly, whereas some have received no improvement or even have been made worse; most of the cases of chronic suppuration have been cured or greatly relieved; tinnitus aurium and vertigo have been relieved, as a rule, but the accompanying deafness usually has remained unchanged.

From this mass of material several facts can be established, viz, that in certain cases of chronic deafness great improvement in hearing follows the removal of the ossicles, in part or whole, with and without the membrana tympani; that, in certain cases of chronic deafness of apparently middle-ear origin, the complete removal of the stapes is unattended with improvement in hearing; that the removal of one or all the ossicles and membrana tympani is not productive by itself of any great degree of deafness;[1] that incisions in the membrana tympani heal rapidly by first intention, when the ear is properly prepared and prior to the operation is free from suppurating processes; that the operation is attended with but slight inconvenience to the patient, the total disability lasting, as a rule, not over twenty-four hours, and with no risk of life of itself; that the treatment of chronic suppurative otitis media by removal of the remains of the membrana tympani and ossicles for the purpose of eliminating causes, such as carious bone, and establishing free drainage for the discharge of pus is a legitimate and purely surgical practice, which is just as applicable here and is followed by as good results as in most other parts of the body; and, finally, that certain cases of tinnitus aurium and vertigo are benefited by releasing the stapes from its attachment to the incus and surrounding adhesions.

With these facts before us it is obvious that in certain cases of chronic deafness there are surgical measures for relief, but the difficulty at present lies in the

[1] Würdemann has reported a single instance where total deafness followed the removal of the ossiculæ for chronic aural catarrh, which he thought was due to hæmorrhage into the labyrinth, with the formation of a clot and its subsequent organization.

inability to recognize, among those who will not, the cases which will yield good results from operation. As it is yet impossible in many cases to distinguish deafness due to middle ear causes from that of central origin, changes in the nerve or internal ear, and as the results of operative treatment in the latter classes must necessarily be of a negative character, it is very important in consideration of the prognosis to study intimately the minute differences in the symptoms of cases which yield unlike results and especially after the successful removal of the stapes, since by this means the contra-indications of the operation can be more clearly determined.

The number of cases which the writer has had the opportunity of studying is too small for the basis of a just conclusion, and recourse has been made to a study of the reports of similar cases in the practice of others; however, one thing is very obvious, and it requires very little experience to prove it, i. e., the great difference in the bond of union between the foot plate of the stapes and the margin of the oval window. Furthermore, when the stapes is removed with great difficulty, perhaps only after the foot plate has been broken, and in small pieces, the improvement in hearing is usually great and, on the contrary, when it is easily removed, often by simply pulling on the head with a hook inserted between the cruræ, the hearing is usually unchanged by the operation.

It would seem, then, that deafness is an indication for operation only in those cases where the stapes is firmly fixed in the oval window, and the firm fixation of the stapes is found especially in chronic dry catarrh of the middle ear, sclerosis of the tympanum, the principal symptom of which is deafness, of insidious origin, continuous and progressive in character, and the chief pathological changes, that are recognized late in the disease, are a thinness of the membrana tympani, which is usually of increased transparency, often retracted and immobile; a rigidity of the chain of ossicles; an atrophy of the cruræ of the stapes, and firm fixation of the foot plate, often by osiffic union with the margin of the oval window. In making a diagnosis of this trouble the chief considerations to be borne in mind are the history of the insidious onset without suppurative changes and the freedom of the membrana tympani from old scars or adhesions. Complicated cases can not always be recognized with certainty. In cases of tinnitus aurium, Menière's disease, deafness following acute and chronic suppurative otitis media, also deafness due to senility and calcareous deposits in the membrana tympani, the stapes is easily removed, but in these cases there will be no great improvement in hearing as a result of its removal; therefore, the operations should not be undertaken for the relief of deafness. The condition of the hearing after the removal of the stapes is better in recent cases of dry catarrh, where it may become nearly normal, than in the older cases; this seems to indicate that as a result of the long-continued fixation of the stapes certain changes occur in the deeper structures of the ear and gives rise to the question of early operation for the prevention and arrest of the progressive deafness in cases of established dry catarrh, where the diagnosis is certain, but as yet the hearing is not greatly impaired.

The writer does not wish to convey the impression that this is the only class of cases where a removal of the ossicles will be followed by an improvement in hearing, but that with our present knowledge it is the only class where the diagnosis is fairly certain and the patient can be assured of a reasonable improvement in hearing from a successful operation. When anchylosis of the ossicles from any cause is broken up the hearing will be improved if there exists no deeper causes of deafness, but here the exact state of affairs can only be determined by the operation, and therefore the result is uncertain. If the stapes is firmly fastened in the oval window by bony deposits, little improvement in hearing can be expected from its disarticulation with the incus, a practice that has been followed by some few operators. In giving a prognosis of an operation for the removal of the stapes

an important fact to be borne in mind is the great difficulty of extracting the foot plate in those cases where there is ossific union with the margin of the oval window: where the external meatus is very narrow or the window is concealed from view it may be impossible to extract the ossicle.

In chronic suppuration of the tympanum the continued formation of pus depends chiefly upon the retention of the inflammatory products from want of a proper outlet, granulation tissue, caries of the ossiculæ, or walls of the middle ear, cholesteatomata of the attic, aditus, or antrum, and chronic mastoid inflammation, and it is very difficult to determine which of these causes are active in producing the discharge of a given case. Under these circumstances the treatment of chronic aural suppuration should be governed by a proper spirit of conservatism, and, except in certain cases, the older and milder means, such as douches, with the occasional cleansing of the tympanum as well as possible by the physician, removal or cauterization of granulations, and application of mild antiseptic solutions or powders, should be persisted in until it becomes obvious that no result will come from these measures.

Those cases where in the beginning the diagnosis of mastoid disease is clear form an exception to the above, and as spontaneous cure is rare and considerable danger of cerebral complications exists so long as the suppuration continues, an early operation is advisable. Cases are sometimes presented where the suppuration has persisted for years, and under these circumstances it is reasonably assured that there are causes present which require immediate surgical treatment. Many of these cases have only a very small outlet for the discharge, situated in the upper posterior segment of the membrana tympani, and surrounded by thickened edges which increase in size with every acute exacerbation, make smaller the narrow channel and threaten its complete occlusion. The latter class can be recognized at sight by the pathological appearances of the membrana tympani in consideration with the history of continued suppuration, and demands early operative treatment. It is the writer's opinion that an ear which has healed without operation, with the formation of dense scar tissue, and strong adhesions between the remains of the membrana tympani and inner walls of the tympanum, so as to close off completely the cavity of the middle ear from external and atmospheric influences, is less liable to recurrent attacks of suppuration than those where the ossicles and membrana tympani have been removed. Vertigo and tinnitus aurium when caused by adhesions between the membrana tympani or ossicles and the inner wall of the tympanum indicate the necessity of surgical interference, but when the cause of these symptoms are not manifest on examination of the parts treatment of any kind is experimental.

There remain for consideration two classes, which Kessel has tabulated among the conditions requiring a removal of the membrana tympani and ossicles, viz, entire calcification of the membrana tympani combined with difficult hearing and a normal acoustic nerve, and cases of incurable occlusion of the Eustachian tube. In the former class it is impossible to determine that the acoustic nerve is in a normal condition, and with a rigid membrana tympani there may exist, without recognition, anchylosis of the ossicles, or even firm fixation of the stapes. The writer found a considerable absorption of the remains took place after the removal by excision of one-half of a large horseshoe-shaped calcareous deposit, beginning at the line of division and developed by the hyperæmia and other changes incident to the process of repair. Therefore it seems to him that, if the exact conditions set down by Kessel could be determined, milder measures than the removal of the membrana tympani and ossicles, such as simple incision or the removal of pieces of the deposit, might be practiced with equally as good results in these cases. The cases of incurable occlusion of the Eustachian tube are very rare, and none have come under the writer's experience; however, he would suggest as a prelimi-

nary operation the production of a triangular-shaped opening in the membrana tympani with the base downward, made from an inverted V-shaped flap, which have been shown by v. Troeltsch and McKeown to remain patent for a long time.

From the above it will be seen that the principles governing the operative treatment of these middle ear affections are of two different types, and the cases have been divided into two groups accordingly, by Stacke, viz: The first, cases of chronic suppuration, often imperatively demands surgical interference to save life, whereas the second class, cases of deafness, tinnitus aurium, etc., resorts to surgical treatment merely from the hope of improving hearing, relieving the distressing tinnitus, or other conditions of no vital importance. In the first group, immediately after the operation severe and even alarming symptoms sometimes appear and depend largely on the condition of the diseased ear, the skill of the operator, the extent to which the parts are removed, and the accidents peculiar to the seat and circumstances of the operation. Nausea and dizziness are the particular symptoms after the surgical treatment of the second group, and the patient experiences but little discomfort from the operation.

The extent to which the parts have been removed and the method of operating has been varied considerably by different men, and therefore it is important to define the exact limits of the operation necessary in a given case to give the best results with the least inconvenience to the patient. In cases of chronic suppuration most operators have found that an improvement in hearing follows the removal of the membrana tympani and larger ossicles, and that this improvement is partially lost when the membrana tympani re-forms. It is on this account that many operators remove the membrana tympani as completely as possible and prevent its re-formation by such means as the application of caustics or secondary excision. In the same class of cases there is also under debate the question, what ossicles shall be removed, and here the argument is concentrated especially upon the extraction of the incus. Furthermore, when the disease has extended to the antrum, the simple excision of the membrana tympani and extraction of the larger ossicles sometimes will not be sufficient to effect a cure, and therefore Stacke devised his method for operating in these cases, by which the bony partition between the malleo-incudal space, the aditus, and antrum and the external meatus is removed and a free communication established between these cavities.

In the writer's opinion, deafness is of secondary importance in suppurating cases, and a re-formation of the membrana tympani, which will shut off the deeper cavities of the temporal bone, is of greater value to the patient than the slight improvement in hearing that attends its non-development. Therefore in the treatment of this affection it is advised to remove as little as possible of the membrana tympani, that its re-formation will be better assured; the malleus should be withdrawn after cutting close around it to free it from adhesions with the membrana tympani, taking especial care to free the articular head, and the incus should also be extracted when it can be easily without injuring the neighboring parts. The removal of the incus brings with it, as a rule, any remnants of the head of the malleus that may have been left after the latter ossicle has been extracted in the carious condition and makes a free communication between the lower portion of the tympanum and the attic, aditus, and antrum. The ossicle is sometimes the seat of carious changes.

The removal of the incus is therefore desirable, since it enables the operator to better cleanse the middle ear, prevents the ossicle from becoming a foreign body, eliminates a possible source of continued suppuration, and liberates the head of the stapes from part of its attachments. With deep-seated inflammation in the mastoid, the radical operation proposed by Stacke or some of the various mastoid operations will often be necessary to effect a cure.

In the earlier operations for the relief of deafness the removal of all the ossicles was recommended, but later the observations of Jack and Berthold showed conclusively that in cases where the stapes is removed the hearing is better after the opening in the membrana tympani is closed, and that the removal of the stapes is the essential part of the operation. In removing the stapes, the incus is frequently loosened and can be easily extracted without increasing the reaction or time required for healing. If dislodged during the operations on the typanum it is liable to become a foreign body unless removed.

Case 1.—Martin F., aged 23 years, has had chronic otorrhœa of left ear for twelve years. The membrana tympani and malleus were removed February 8, 1891, and the tympanum treated carefully with antiseptic solutions, but the membrana tympani quickly re-formed, and it became necessary to repeat the operation. The second excision of the membrana tympani was performed by Stacke's method, and at the same time some carious spots on the posterior wall of the tympanum were curetted. The latter operation was performed December 9, 1891, was more thorough than the preceding, was not followed by a re-formation of the membrana tympani, and resulted in an almost cessation of the discharge. At the end of three months only a slight amount of moisture could be found in the tympanum after the patient had been lying down for some hours (a symptom of suppuration of the antrum). A great improvement in hearing accompanied the reparative changes of the middle ear.

Case 2.—William D., aged 35 years, has had dry catarrh of the tympanum with marked deafness for more than five years. The membrana tympani, malleus, and incus were easily removed September 11, 1892, and resulted in an improvement in hearing. The membrana tympani re-formed in a short time and the improvement in hearing was partially lost.

Case 3.—Mr. F., aged 55 years, has had dry catarrh of the middle ear for twenty years, and at present deafness is very marked. October 24, 1892, the incus was removed, but in attempting to extract the stapes both cruræ broke off short, leaving the foot plate in the oval window. The incision in the membrana tympani healed rapidly, but the improvement in hearing was very little and not at all satisfactory.

Case 4.—Lydia P., aged 33 years, has had a chronic otorrhœa for ten years, and when examined there was a mass of polypi in the meatus, excessively sensitive to the touch; a large perforation in the membrana tympani; an entire absence of the malleus and a large opening in the posterior upper wall of the meatus, which extended through the bony wall, formed a free communication with the antrum, and showed the existence of mastoid disease, with an attempt on the part of nature to form a spontaneous cure. The patient was treated in a conservative manner for two months, but showed no improvement, and it was decided to operate October 26, 1892. The remains of the membrana tympani, a mass of inflammatory tissue, some carious bone, and several pieces of a cholesteatomatous growth were removed, and the opening between the antrum, tympanum, and meatus enlarged. The patient reacted badly, and there were symptoms of severe meningeal irritation; however, by careful and repeated cleansing and keeping the drainage free, these symptoms abated at the end of ten days, during which time large masses of cholesteatoma were discharged from the meatus. The suppuration entirely ceased at the end of the sixth week, a clean scar formed over the diseased places, and a considerable improvement in hearing followed.

Case 5.—Mary C., aged 21 years, has had chronic otorrhœa of both ears for several years. After treating the parts in the usual way for several months, the membrana tympani and remains of the malleus and incus were removed from the ear which was most diseased November 6, 1893. The incus was found to be normal but the malleus, which was removed intact, had almost completely ulcerated away, leaving but a small portion of the head about the joint. Suppuration entirely ceased at the end of eighteen days, the membrana tympani did not re-form, and the hearing was considerably improved. By continued treatment the discharge of the opposite ear was stopped, but a large perforation remained in the membrane. The hearing is about the same in both ears. During the past six months there have been recurrent attacks of suppuration in both ears.

Case 6.—John B., aged 57 years, has been afflicted with non-suppurating disease of the middle ear for ten years, and Menière's disease for five years. The membrana tympani and all the ossicles were removed in December, 1892, and as a result there were severe dizziness, vomiting, and nausea, for nearly a week, the noises in the head ceased for twenty-four hours, and then they returned with

increased force. The vertigo returned in paroxysms and was as bad as before the operation. The hearing was unchanged. The operation revealed a small exostosis on the inner wall of the tympanum near the round window.

Case 7.—John K., aged 30 years, has had chronic suppuration of the left ear for three years. When first seen the patient was suffering from an abscess which pointed in the mouth, on the left side, near the hammular process, and probably found origin in the middle ear disease, from which it descended along the tissues forming the Eustachian tube. The membrana tympani was greatly thickened and contained a large perforation. The abscess healed rapidly after it was freely incised, but persistent treatment failed to stop the suppuration, and at the end of three months, January 8, 1893, the remains of the membrana tympani and malleus were removed. Facial paralysis and free suppuration followed the operation and continued for two months, when the discharge ceased and a recovery from the paralysis soon occurred. The membrana tympani did not re-form and a considerable improvement in hearing took place.

Case 8.—Samuel J., aged 53 years, has had progressively increasing deafness for twenty-five years, due to dry aural catarrh. The stapes was removed in pieces with great difficulty after both cruræ had broken off, and a great improvement in hearing is the result. Operation January 8, 1893.

Case 9.—George C., aged 60 years, has had marked deafness, the result of chronic suppurating otitis media, for which the stapes was removed in its totality February 12, 1893. The operation was easy, although the membrana tympani was closely bound to the promotory with old adhesions. The result was entirely negative.

Case 10.—Sarah C., aged 24 years, has had marked deafness due to dry aural catarrh, for which the stapes was removed in pieces March 14, 1893, with great difficulty. The improvement in hearing was very great and brought the ear very near its normal ability. The deafness had been very bad for three years only.

Case 11.—Mr. B. J. R., age 55 years, has had progressively increasing deafness for twenty years, which was apparently due to a large horseshoe-shaped calcareous deposit that partly surrounded the manubrium and occupied nearly the whole of the membrana tympani. March 18, 1893, one-half of the calcareous plaque was removed with very little improvement in hearing; and later, April 7, under cocaine anæsthesia, the stapes was partially removed and followed by considerable relief of the deafness.

THE INDICATIONS AND PREFERABLE METHODS FOR MASTOID OPERATIONS.

By SETH SCOTT BISHOP, M. D., of Chicago, Ill.,

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When and how shall we operate in mastoid disease? Among American surgeons there is a wide diversity of opinions, especially as to what symptoms constitute a positive demand for opening the mastoid process. My observations leave the impression that the majority of surgeons are too conservative, both as to the time selected for surgical interference and the extent of the operation. While conservatism is an admirable trait in a surgeon, so long as caution is not merged in timidity, so far as I have seen its influence in this class of cases it has proved detrimental to the patients. I have seen fatal results follow (1) refusal to allow the operation; (2) after operations too long deferred, and (3) after operations that were performed too timidly to remove all the diseased tissue, but I have never known death to occur as a direct result of the operation itself. We all appreciate the gravity of this undertaking, but in view of the fact that the disease demanding it is far more dangerous than the surgical measures for its relief, greater freedom of action and boldness of methods will add luster to the records of our work.

When shall we operate? The weight of experience and the testimony of trustworthy authorities favor early operations. If we wait for the very grave symptoms: fever, rigors, vomiting, vertigo, widely diffused pains in the head and neck, thickly furred, tremulous, and indented tongue, delirium, etc.; the chances of success are discouragingly diminished. I do not believe it is wise to postpone

an operation until these symptoms occur, unless the patient is suffering from some other affection that renders recovery hopeless, or unless the prostration is so great as to preclude the possibility of survival. There are tentative methods of treatment that are proper and promising in incipient mastoiditis unattended by urgent or dangerous symptoms. I have often subdued periostitis by the use of counter irritation, compresses, and the free extraction of blood by leeches and wet warm applications. Many cases of mastoid disease may be cut short by this early active treatment. I have seen very acute attacks with intense pain relieved permanently in this manner. If there is also acute inflammation of the middle ear, additional leeches should be applied about the tragus and an opiate given. If decided relief does not occur within twenty-four or forty-eight hours we should not hesitate to make Wilde's incision, or if this does not relieve, open the bone. This statement, in my opinion, embodies as great conservatism as our duty to the patient justifies. Obviously, any rules that may be laid down are more or less elastic. For example: A case recently came under my observation in which the mastoid had been opened. Another fluctuation swelling appeared above the auricle. I advised opening it, and pus was liberated. Subsequently the patient was brought to me with this opening almost closed, but pus could be pressed from it. There was severe periostitis involving the whole mastoid, temporal, and zygomatic regions. I advised free incision extending through the two previous openings, but one of my assistants, Dr. Holinger, desired to try the effect of pressure with antiseptic compresses. This treatment alone dispelled all the threatening symptoms in less than two days.

I have formulated the following six rules by which I have been guided in deciding the perplexing question of an operation: The mastoid process should be opened (1) when there is acute inflammation of the bone that resists palliative treatment; (2) when repeated swellings and abscesses occur; (3) when there is bulging of the posterior and superior wall of the meatus with middle ear suppuration; (4) when there is a fistula; (5) when there are severe pains in the same side of the head as the diseased ear, resisting all other treatment (mastoid cell inflammation); (6) when a foul otorrhœa can not be cured by any other means. These rules may be said to be conservative, and whatever deviation we may indulge in ought to be at once favorable to the operation and the welfare of the patient. Too great temporizing favors sinus thrombosis, septicæmia, brain abscess, and meningitis.

What method of operating shall we pursue? I have usually performed Schwartze's operation, but have also used Stacke's method with gratifying results. It is one of the most difficult, delicate, and dangerous operations in surgery. Since one can not know the extent of the pathological process before entering the bone, it does not appear to be advisable to decide upon any special method of procedure in advance save one: Remove all dead and diseased tissue. Whoever does this does best. Stacke's and Bergmann's operations have the advantage of affording the greatest accessibility of the tympanum, so that if it is necessary to remove necrosed ossicles or diseased tympanic tissue it can be done with greater facility and thoroughness. But it is best to guard against collapse of the walls of the meatus and resulting stenosis by inserting a tube in the canal. Schwartze's operation is sufficient for most cases. It is much simpler and leaves a less extensive wound. The operations of Wolf and Kuster through the meatus I have never ventured upon for fear of not possessing sufficient skill to remove all the diseased tissue through such a narrow field of vision. All these operations are described in the admirable monograph on the surgery of the ear by Albert H. Tuttle, of Boston.

There are a few points in this connection worth mentioning, for they are closely related to a successful issue. The best illumination is gained by the use of light

reflected from the mirror on the operator's forehead. This affords a decided advantage over direct illumination. The light is more intense, can be thrown into the opening of the bone in every direction, and there are no shadows to obscure the field. It is safer not to close the wound entirely until it has healed from the bottom. When the interior has filled with cicatricial tissue up to the surface of the outer table, it is safe to allow it to close. I have had good results after closing the wound completely at the time of operation, but it is certainly not so safe a plan. The best dressing is aristol sprinkled over the wound surfaces to cover them entirely. Then iodoform gauze should be placed lightly in the mouth of that part of the wound chosen to remain open. It should not be packed down to the bottom of the wound so as to crowd any discharges inward, but it should extend just far enough inward to keep the cutaneous tissues from closing over the superficial opening in the bone until the deep wound is well. Aristol has two excellent qualities: It is the best cicatrizant we possess, and it has the additional advantage of being to some extent an anæsthetic. While iodoform is irritant and toxic, and boracic acid sometimes produces pain, aristol soothes and heals without any ill effects. After stitching that part of the wound to be closed and dressing the open mouth for drainage, the whole is covered with iodoform gauze, absorbent cotton, and a net bandage. This bandage is made of the common mosquito netting, which, as used in the Northern States, is sized with a preparation of glue. The roll of bandage is dipped in water, just before applying, until it is wet through. Then the water is squeezed out and the bandage applied as usual. When it dries the layers adhere together firmly, so as to retain their position for many days in succession without interference.

But the most perplexing question before us is, When shall we open the bone? My conviction is that the earlier the operation is performed the better our records will be. We should operate while the condition of the patient favors resolution instead of dissolution, and all dead and diseased tissue should be removed. The safest and simplest rule by which I have been generally guided is this: When there is a fistula, or a group of unyielding symptoms of serious sickness undoubtedly due to the ear disease, penetrate the bone. Unlock the vault that holds our treasure and the sufferer's doom. Give vent to the pent-up furies of disease, as Æolus loosed the struggling winds. A merciless and unrelenting foe has stormed the fortress of the brain; the citadel of life. No truce is safe, and now heroic action only conquers man's great foe.

DISCUSSION.

Dr. C. R. Holmes, Cincinnati, Ohio. I can not agree with Dr. Cohn that the operation by Stacke's method is more aseptic than when the operation is performed through the external canal. The results from the operation in chronic catarrh of the middle ear have been anything but satisfactory, and therefore there is little to justify us in making such an extensive operation as proposed. I do not think that drills and trephines, as mentioned in Dr. Brose's paper, should even be considered as a part of the armamentarium of the modern aural surgeon. They are instruments that had their day and defenders, but are, and justly so, relegated to the past. I am not in favor of using the drainage tube, as described by Dr. Brose, passing through the opening in the mastoid into the middle ear and out of the external canal; because, if the disease warranted such an extensive interference with the middle ear, the method of operation is not radical enough; and if only for the purpose of giving vent to the mastoid cells, it is not good surgery to meddle so much with the middle ear and endanger the position of the ossicles. I have examined cases where the stapes had been removed; Schwartze's and Lucae's experience have been very unsatisfactory. I read a letter recently received from

Prof. Schwartze and another from Dr. Stacke, wherein both spoke unfavorably of the operation; and Prof. Schwartze, referring to the reports by Dr. Jack, declared that the time for judgment upon these cases is entirely too short, and at present he does not believe the results will be what has been claimed. I agree with Dr. Bishop that aural surgeons have been too conservative in operating, and it is especially true that many do operate, but are too timid. If we have once determined that it is necessary to operate, we should use the utmost care to guard against opening into dangerous parts, but we should be bold enough to remove all the diseased tissue. I beg to call the attention of gentlemen to the fact that Wilde's incision should not be practiced. Schwartze has omitted it in his last work because it is painful, and, if the disease has advanced far enough to warrant the operation, the cells in nearly every case are also involved, and the patient can only be benefited by opening the bony cortex. If the flap is formed from the lining of the external canal, according to Stacke there can be no collapse after the operation, and with proper packing stenosis should never occur. In the experience of the speaker, the canal will admit of the largest-sized speculum being used, and every part of the cavity can be freely inspected. We do not expect the cavity formed by the removal of diseased tissue to be refilled with cicatricial tissue: in fact this is the most undesirable thing that can happen. What we do want is a cavity covered with healthy epithelial cells; and this can never be accomplished unless firm and persistent packing is practiced until all of the cavity is covered with epithelium.

Prof. N. Politzer. I never open the antrum in acute cases. The mastoid trouble is, in acute cases, rarely in communication with the antrum, and it is better simply to open the mastoid cells. We have thus a clean wound, which closes rapidly; the suppuration in the middle ear ceases sooner, and hearing returns. Of late I have tamponed the wound for one or two days with iodoform gauze; in fact I have sometimes closed the wound immediately after the operation by sutures, after having, of course, scraped away all diseased bone. These patients were able to leave the hospital after one week. In cases of chronic sclerotic middle-ear catarrh, on the whole, I do not expect to get good results from the extraction of the ossicles. In some cases the operation is liable to impair the condition of the ear. In chronic purulent cases I think that we must expect little from extraction of the ossicles alone. I have employed Küster's method of opening the attic and antrum with good results.

Dr. Felix Cohn. I wish again to state distinctly that I am not an advocate of the excision of the ossicles and tympanum in aural catarrh, no matter by what method, be it extra-auricular or intra-auricular. I also claim no originality, even in the application, as Stacke himself in the first publication of his method at the International Congress in Berlin mentions as one of the indications its applicability in sclerosis. Bürkner, in his text-book, as well as Schwartze, in his handbook, which has just appeared, both refer to the possibility of excision by this method. So far, however, to my personal knowledge, no cases have been recorded. I have reported only two cases, because, not advocating the excision of the ossicles, after having satisfied myself sufficiently of the applicability of the method, I have not yet found a case that, according to the indications enumerated in the paper which I had the honor of reading before you, warranted success by either method. I believe that there are only a few chronic conditions in the tympanic cavity in which excision of the ossicles will produce permanent results; and unless we decide to operate, not to improve the hearing, but, prophylactically, to prevent a progression of the disease or for cases of insufferable tinnitus, we are at present obliged to limit the operations, so that even an otologist commanding a very large material will not find occasion to operate upon many cases in the course of a limited length of time. Even, however, from the two cases operated upon and my personal knowledge of the technique of Stacke's method in cases of suppurative otitis, I claim

that in suitable cases it would be just as advisable, if not preferable, to operate by the extra-auricular method instead of by the intra-auricular. It is an antiseptic, clean, surgical method. It is comparatively easy and it is safe, safer than the extra-auricular. Although I fully agree with Dr. Holmes that the wholesale excision of ossicles should be condemned—I have tried to preach restriction of indication in my article—I can not see that the objection of Dr. Holmes to this method, that it is painful, can be at all considered. Both methods are surgical operations, and as long as the operation has been shown to be practically safe, an incision a couple of inches larger than we have been accustomed to make in the common Wilde's incision should certainly not deter us from employing a method which may give better results even if it were more painful. The real fact is that the extra-auricular method is painless, because the operation must be done in narcosis, and painless in the after-treatment, since the external wound is sewn up, leaving only a small catgut drain in the lower portion of the wound as a precautionary measure.

Dr. S. S. Bishop. I do not often insert a drainage tube in the wound of the mastoid operation. The superficial opening is maintained by the pledget of iodoform gauze until the wound heals from the bottom to the opening in the bone. After Stacke's operation I have been obliged to use a tube in the auditory canal for a short time to prevent stenosis. For this purpose a hard-rubber tube was used for one day, followed by a soft-rubber tube for a few days. Since the discussion has turned upon the question of operating for the removal of the drumhead and ossicles for dry catarrh of the middle ear, I will add a few remarks to those which have already been made. I have investigated this subject sufficiently to make me very cautious. Four cases have come to my knowledge, in all of which the results were so disastrous as to deter me from operating for this disease. In one instance the operation was followed by total deafness in the operated ear, suppuration, and vertigo. The suppuration was cured, but the hearing was not regained. Another case was that of a physician who heard his watch 2 inches with the affected ear before the operation, but was troubled with tinnitis. The surgeon who removed his ossicles thought the operation would remove the noises and improve the hearing. On the contrary, when the unhappy man came under my observation he had a suppuration in that ear, seemingly intensified noises, and total deafness. We succeeded in stopping the discharge, and a few weeks ago I found that the drumhead had been entirely reproduced. He still suffers from absolute deafness in the operated ear, and says that the tinnitis appears to be worse, for he can hear nothing else. He traveled about 3,000 miles from home for this operation. Two other cases with similar unfortunate results have been recently reported to me by Dr. Walker, of Denver, and a Kansas City physician, both of whom have promised to furnish me with full reports of these cases. I have had correspondence with other physicians who have operated for dry catarrh, and their experiences, together with my observations of the deplorable conditions that have resulted in the only cases I have ever seen after the procedure, have kept me from trying it. I have often opened the drumhead and removed it without any unpleasant results and with temporary benefit; but the discouraging feature of this operation is the difficulty of preventing a closing of the perforation and regeneration of the membrane. The same occurs after removal of the ossicles. A gentleman has lately consulted me for deafness, saying that an aurist removed his chain of ossicles, but the drumhead would re-form after such operation. The surgeon instructed his patient to return for operation every time the drumhead was reproduced. This put him to considerable inconvenience, as his residence was about 1,000 miles distant from the aurist. But with the hope of finally regaining his hearing he was willing to take these periodical journeys, for he happens to be a very wealthy merchant. In the reports of these operations I have looked to see if such cases were recorded, but they appear to have been overlooked. In ulceration, suppuration, necrosis, etc., I do not hesitate to do these operations, and I take it that every surgeon approves of them as good surgery.

THE PHONOGRAPH IN THE TREATMENT OF DEAFNESS.

By JOHNSON ELIOT, M.D., of Washington, D. C.

Over a year since my attention was directed to the use of the phonograph as a means of treating chronic catarrhal otitis. Many years since we were advised to exercise the muscles of the tympanum by means of sound waves. This performed through the medium of aural tubes proved to be tedious and was abandoned. It was thought that in the phonograph we had an instrument which would yield the desired results. Though the Edison phonograph had been used for various diagnostic purposes, the credit of introducing it in deafness belongs to Dr. H. F. Gray, of Baltimore, Md., who has recorded some beautiful results. The most of what follows is familiar, but I think best to incorporate it.

Sounds are but a succession of falling waves of air capable of affecting the auditory nerves. Whether they fall regularly or not, they may all be traced to the vibrations of some material body. When a fork is struck the edges are set into vibrations; this vibratory motion is communicated to the air, in which it spreads in waves of condensation and rarefaction having the fork in the center. Where the spherical diffusion is interfered with, as in tubes, the sound is more distinct. Sounds falling upon the diaphragm of a phonograph cause, through its style, a series of minute depression upon a revolving cylinder of wax. Be the sounds composed of many or few vibrations it is analyzed and markings corresponding to the number of vibrations are recorded. From our phonogram thus made we can reproduce the sound time after time. The style drops into the depressions on the cylinder and the diaphragm gives back to the air the vibrations which composed the original sound, though with less intensity. From this we understand that sound is composed of a series of vibrations, and the phonograph is capable of reproducing these and conveying them to the ear. For their effect here we must look toward massage. The vibrations are but a series of taps (tapotement) on the membrana tympani, which are carried by means of the ossicles to the internal ear. The taps cause, as in other parts where massage is used, increase of the venous circulation, freer absorption, prevents and resolves stiffness and atrophy of muscles, and favors the repair of tissues. From this it would seem that the treatment would be successful, but I regret to say my clinical experience does not bear out the claims.

Deafness may be divided generally speaking into two classes, where the middle ear is affected and where the internal ear is at fault. Those affections of the auricle and external meatus are omitted as having no bearing. In the middle ear our most common lesions are catarrhal, generally with a thickened membrana tympani, a sclerosed lining membrane, anchylosis of the ossicles, and depression of the membrane often by contraction of the tensor tympani muscle; the auditory nerve may be but little affected. In these we have the indications of the massage treatment as applied by means of the phonograph. Could we but limit our action to the middle ear or prevent shock to the internal ear, I would fully concur in this belief. To break the false unions of the ossicles and cause absorption of callus thrown out will require sounds of larger volume than the ordinary speaking voice as recorded by the phonograph; in fact these sounds are often not heard by the patient. To persist in the use of such phonograms I consider harmful, as in the endeavor to appreciate the sound one is kept on the *qui vive*, and fatigue of the muscles of the tympanum will ensue. This generally passes, but we know permanent effects may result. In the endeavor to procure sounds of larger volume I had various cylinders made, also making use of musical ones. Intense sounds imply greater amplitude of vibrations, which in the case of the ear means a strong stroke upon the labyrinthine fluids. Normally the labyrinth is protected from

blows and concussions, as, in addition to the yielding which the membranous walls afford, we have a special valve at the fenestra rotunda, the membrana tympani secondaria. This idea is based upon the communication existing between the scala vestibuli and the scala tympani, which is generally admitted.

Physiology teaches that when an impulse is received upon the membrana tympani it is carried by means of the endolymph to its corresponding organ of Corti, which it stimulates, and sends the impulse to the sensorium. This is true, whatever theory of auditory nerve stimulation we accept, as we know the terminal filaments of these nerves are stimulated by variations in the tension of the fluids of the internal ear. If the impulse is great, Corti's organs are protected by the valve action at the round window. This bulging relieves the pressure and prevents overstimulation of the nerve, but in chronic catarrhal otitis the lining membrane of the tympanic cavity is thickened or sclerosed. These changes, involving the membrane at the round window, render it less elastic and less capable of yielding. When this condition is present, we can readily understand that a vibration starting at the footplate of the stapes will fall with augmented force upon the terminal filaments of the auditory nerve. But little is known of the pathology of the special nerve trunks. Overstimulation would cause fatigue and loss of irritability; the sensations would be obtunded as in the case of the olfactory nerves in ozæna. That this is permanent I am unable to say. When deafness depends on labyrinth or nerve changes, can we hope to again bring into activity a nerve by means of massage applied through the ossicles? I do not think it possible; for since phonographic massage will lessen the activity of the auditory nerve, we certainly could not by the same means restore the nerve to its original activity.

In the following cases the deafness depended more especially on changes in the middle ear, and as many are similar I have selected eight from a series of eighteen, all however proving failures.

Case 2.—Adult, female; health good; applied for relief of tinnitus aurium of two years' standing, following acute rhinitis; membrane normal but slightly depressed; H. D. R. $\frac{40}{50}$, H. D. L. $\frac{50}{50}$; after first treatment tinnitus abated for one day, then returned; ten further treatments given every other day had no influence.

Case 3.—Male, aged 38 years; hearing impaired fourteen years; health good; membrane opaque; anchylosis of malleus and incus; adhesion of membrane; history negative; H. D. R. $\frac{4}{50}$, H. D. L. $\frac{7}{50}$; tinnitus; treatment every day from June 13 to July 9, then every other day until August 12; the adhesion gave way slightly, but no change was made in audition.

Case 4.—Male, 22 years; good health; increasing deafness for four years; membrane opaque; firm anchylosis; nerve in good condition; H. D. R. $\frac{5}{50}$, H. D. L. $\frac{9}{50}$; under treatment five months, generally three times weekly; cause stated as repeated colds and tobacco; treatment was of no benefit.

Case 8.—Female, aged 40 years; health good; deafness nine years, following typhoid fever; tinnitus; H. D. R. $\frac{8}{50}$, H. D. L. $\frac{10}{50}$; membrane lusterless; bone conduction fairly good; anchylosis; treated every third day for four months; audition remained stationary. From a letter received a few days since she states that the phonograph increased her trouble.

Case 9.—Female, aged 52 years; seven years' duration; commenced with abscess in left ear; right ear taking on chronic inflammation. There was constant tinnitus and post-nasal catarrh; bone conduction good; treatment about every other day for nearly seven months; H. D. R. $\frac{4}{50}$, H. D. L. $\frac{2}{50}$; no change in the hearing distance. While under treatment this patient suffered from an attack of "nervous prostration." As there was no exciting cause, it has been a question with me whether my treatment could have had any influence in its production. During the attack the phonograph was not used.

Case 11.—Female, aged 45 years; no cause assigned; duration twenty to twenty-five years; H. D. R. $\frac{1}{50}$, H. D. L. $\frac{0}{50}$; tuning fork faintly heard through the bones of the skull; two and a half months' treatment was negative.

Case 15.—Male, adult; adhesion of membrane; no nasal or pharyngeal trouble; bone conduction remarkably acute; H. D. R. contact, H. D. L. $\frac{2}{50}$. This case I saw but three times and can hardly consider him a patient of mine. He stated that he had been under a five months' treatment in Baltimore just preceding his visit to me and that his hearing decreased from the beginning of the treatment.

Case 16.—Adult, male; health good; H. D. R. $\frac{50}{50}$; H. D. L. $\frac{50}{50}$; post-nasal catarrh; Eustachian tubes patent; membrane normal; bone conduction good; applied for relief of tinnitus; treatment for nearly three months proved negative.

CLINICAL CONTRIBUTION TO THE STUDY OF AURAL SYPHILIS.

By MAX TOEPLITZ, M. D., of New York.

Aural syphilis may be manifested during the secondary and tertiary stages, and some rare cases also even of primary induration of the auricle have been reported. Secondary affections are, as a rule, transmitted through the pharnyx and naso-pharnyx through the Eustachian tubes into the middle ear, or they appear in the external meatus as condylomata or ulcers. Tertiary syphilis is characterized by chronic inflammations of the periosteum of the labyrinth, with subsequent hyperostosis or exostosis of the petrous bone or of the cavities of the labyrinth leading to stenosis, or even occlusion of the latter. All cases, however, exhibiting syphilitic affections of the labyrinth are due to hereditary or to acquired syphilis of long standing.

The case which I have but recently observed is remarkable by the fact that the labyrinth was affected primarily in the course of a freshly acquired case of syphilis, and that the aural affection began simultaneously with the appearance of roseola.

The patient, a physician, æt. 41, married, of excellent repute and standing, presented himself at the aural department of the New York Ophthalmic and Aural Institute on August 1, 1892, with the complaint only of deafness in the left ear, other symptoms being absent. Otoscopy revealed moderate congestion of Shrapnell's membrane, which seemed to have disappeared on the following day upon application of two leeches to the tragus. Politzerization used for diagnostic purposes did not improve the hearing. Hearing power horologium, A. S. $\frac{\text{contact}}{36'}$ A. D. $=\frac{18}{36}$. On August 2, hearing, A. S. $=\frac{1}{36}$, improved. August 3, hearing worse; leeches to the mastoid. On the fourth day of observation the right ear, which had been endowed with very acute hearing, had become affected. The examination with tuning forks, which did not give any distinct results in the very beginning as to the relation of bone and air conduction and seemed to be leaning more toward a decrease of bone conduction, revealed on August 4 positive Rinné in both ears, but there existed almost as much bone conduction as air conduction, the former being decidedly decreased. My diagnosis of otitis interna was now fully justifiable, on account of the sudden development of deafness and the great difference of the course of the affection from that of middle otitis.

In order to ascertain the etiology, I questioned the patient about former attacks of syphilis, but with entirely negative result. After repeated inquiries for fresh lesions, the Doctor presented the middle finger of his left hand, which bore in the center a round, hard tumor of the size of a large cherry, representing a genuine primary chancre, contracted during gynecological examinations. Dr. Sigmund Lustgarten confirmed my diagnosis of syphilis. At the same time pharyngeal mucous patches and a beginning roseola were found. Energetic treatment with inunctions of blue ointment were immediately resorted to and injections of pilocarpine were independently made by the patient. The further course of the affections ran as follows:

August 10: Patient experienced a tendency to fall upon rising in the morning, and especially when awakened out of sleep. The walls of the building seemed shaking. He felt once or twice, for a minute, as if he would like to put his hands against the wall, but the phenomenon was not very marked.

August 16: H. P. H. A. U. $=\frac{\text{contact}}{36'}$. Tuning fork perceived as above. Ordinary conversation is well understood, but the patient has to pay strict attention. Whisper, A. D. $=\frac{8'}{20'}$, A. S. $=\frac{18''}{20''}$; conversation, A. D. $=\frac{10'}{60'}$, A. S. $=\frac{6'}{60'}$.

August 17: Result of examination with tuning forks unchanged; Weber's experiment, T. F. perceived in either side equally well; T. F., both high and low, are perceived when placed upon R. mastoid in A. S., but when R. ear is closed in A. D.; R. E. does not hear all the high notes of the piano above *g'*; R. E. above last *e*; the high notes were perceived as mere taps without the faintest musical sound.

October: In the beginning of October the hearing of A. D. was almost normal; A. S. somewhat improved.

November 23: Whisper, A. S. $= \frac{15'}{20'}$; watch, A. S. $- \frac{4''}{36''}$; conversation, $= \frac{60'}{60'}$; Rinné, A. S., negative.

Weber's experiment: Diapason vortex not perceived in either ear; high and low tuning forks equally well perceived; T. F. placed upon R. mastoid, best perceived in A. S.; hearing for the watch, whisper, tuning fork; conversation was normal in A. D.; musical hearing normal. Mucous patches of the soft palate were not quite healed.

The special features of this case are as follows: (1) The affection of the labyrinth occurred after the appearance of the pharyngeal mucous patches and simultaneously with the appearance of roseala; (2) the aural lesion took place during the secondary stage without attacking the middle ear; (3) the diagnosis of syphilis was made from the ear.

It may be doubted that the affection was located in the labyrinth and in its stead the outer wall of the labyrinth, and more especially the region around the oval window, may be preferred for its location. The entire course of the disease, however, contradicts such an assumption, and also the suddenness of the beginning, the well-nigh entire absence of inflammatory signs in the membrana tympani, the mutual relation of both ears during the attack, the relation of bone conduction and the attack of vertigo; all speak in favor of labyrinthine disease.

The pathological changes produced by the syphilitic poison, which entered the lymphatic and blood current of the labyrinth from the pharynx through the aqueducts and the blood vessels, probably consisted in inflammatory alterations of the membranous portion, the periosteum, and the surrounding lymph of the vestibule, and the first turn of the cochlea, with an increase of cellular elements and hæmorrhages. All these changes disappeared after energetic antisyphilitic treatment. I have looked over the literature of the subject and have not found a similar case of labyrinthine disease due to secondary syphilis in its earliest stage without implicating the middle ear. Politzer* only mentions in general that in affections of the middle ear due to syphilis the perception of the tuning fork through the skull may be lessened or absent (complication with syphilitic disease of the labyrinth), a fact which essentially supports the diagnosis of specific aural affection when other syphilitic symptoms are present.

THE PRESENT CONDITION OF OTOLOGY IN EUROPE AND THE OPERATION OF EXCISION OF THE OSSICLES IN CHRONIC SUPPURATIVE OR NON-SUPPURATIVE DISEASE OF THE MIDDLE EAR (PROGRESSIVE OR PROLIFEROUS SCLEROSIS), WITH CASES.

By LAWRENCE TURNBULL, M. D., of Philadelphia, Pa.

Having spent the greater part of the years 1892–'93 on the Continent and in Great Britain, I made it my business, as well as pleasure, to compare the present position of otology and note its progress as a special department, as also the character of the representative men who practice it, with that of twenty years ago. I found the advance had been made in several directions. First, a more perfect knowledge of the normal, pathologic and microscopic anatomy of the ear both in men and animals. Second, with this precise knowledge of anatomy there followed a more rational use of therapeutics both in their local and general application. No haphazard probing, but definite operative and mechanical methods of treatment, with perfect illumination by gas or electricity. The old empirical use of the syringe

* Text-book, first edition (German), p. 693.

with hot alkaline solutions, without looking into the ear, has, we are happy to state, even among general practitioners, entirely disappeared. Almost all are provided with an aural and nasal speculum and some form of mirror with a Politzer air douche. Third, the number of good, scientific, yet practical works on the ear and its diseases are numerous, well illustrated, and can be had at a moderate price. Among these are the works of Pritchard, S. MacNaughton Jones, and Barr, of England; Baratoux, of France, and Hartmann, of Germany; while the more elaborate works of Politzer, Gruber, and Schwartze are prized by the aurist, as they are replete with accounts of improvements in this department brought up to date, and even the English translation of these works has passed through several editions, showing the great demand there exists for this kind of knowledge, not only by the student, but by the active medical man. While in Liverpool we visited the learned Dr. Stone, who is recognized as an authority in that city, and who has done himself great credit by his translation of the admirable work of Politzer, describing the technique of the various instruments and apparatus for the proper dissection both of the normal and pathological ear. Another important union has taken place between the laryngologist, the rhinologist, and the otologist, as without the knowledge of the use of the laryngoscope and the rhinoscope complete diagnosis would not be possible, as most aural maladies, either directly or indirectly, are associated with naso-pharyngeal diseases, and are so described and treated in the more recent works on the ear, throat, and nose. This happy combination was well illustrated in the recent meeting of the British Laryngological and Rhinological Association, in London, which I attended in June, 1892, when papers were read and discussed on these subjects to the advantage and satisfaction of all concerned.

I was also much pleased to find that the sections of otology and laryngology were united at the meeting of the British Medical Association at Nottingham, held from July 26 to 30, 1892, and a large number of interesting papers were read and discussed. There were present a number of distinguished representative men of both departments, among them Profs. von Schrotter and Gruber, of Vienna. Prof. Gruber had the honor of being invited to take a seat on the platform in the general meetings. Prior to my visiting London, Prof. Politzer had made a visit and been the recipient of numerous attentions from both the throat and ear specialists.

While in Great Britain I noticed that great attention was paid to the ventilation of the Eustachian tubes, the removal of adenoid growths, and the general and special treatment of naso-pharyngeal diseases as causing deafness, but not a word was said of operative measures for the relief of chronic suppurative inflammation of the tympanum, now considered of much importance. It is now recognized in the United States as a measure which is absolutely necessary. (Described in Part II of this paper.) First, in chronic aural discharges, especially those from diseased bone or polypi, first proposed and performed by Sexton in 1886. Second, for the relief of vertigo and distressing tinnitus aurium. Third, the cure or relief of deafness, or the prevention of its increase, performed by Schwartze in 1885. Often the slightest improvement in the hearing of the human voice is hailed with delight by the long-suffering deaf person, just as the light admitted by the removal of the cataract, or an iridectomy, is a source of great joy to a sightless patient. Gradually we are improving our methods of diagnosis, the only true method being to discover by the tuning fork whether the seat of the disease is in the middle ear or in the nervous apparatus (inner ear). A series of tuning forks has been devised by Hartmann, of Berlin; his lowest is a C fork registering 128 vibrations per second; the highest a C fork, 4 octaves higher, registering 2,048 vibrations per second. The intervening forks are also tuned to the note C and vary from each other by an octave in the scale. When not supplied with these refined methods, having

only an ordinary tuning fork with a clamp, it is well to remember that a great decrease of bone conduction indicates an implication of the internal ear or nervous apparatus, except in old persons, and in cases of syphilitic bone disease in which there is deposit with thickening. The thanks of every aural surgeon are due to Dr. Sexton, of New York, for his devotion to and careful study of operative measures for the relief of chronic, suppurative, and attic disease, as also non-suppurative inflammation of the tympanum, in the face of great opposition, even in his own city.

Dr. J. Baratoux has performed a few operations in Paris, but in his recent work Guide Pratique pour le Traitement des Maladies de l'Oreille, 1892, no mention is made of this mode of treatment. The English have ignored the whole subject, except the operation through the mastoid, by Lane. Our German confrères, who first opposed it at the congress, but are now the strongest advocates for its use, especially Kretschmann, Ludwig, Reinhardt, Grunert, and Kessel, endeavoring to show that the credit of the introduction of the operation for the removal of the malleus and incus from a patient suffering from chronic catarrhal inflammation of the tympanum was due to Kessel in 1877. The operation was without satisfactory results, however, until taken up by Sexton, who proved it not only possible, but advocated the measure and published the first satisfactory results to the world in 1884. It was he who first proposed and performed excision of the membrana tympani and ossicles for the relief and permanent cure of chronic discharges from the ear. I at first was opposed to the operation, but after a consultation and conference with Dr. Sexton I was convinced of its value. At the Jefferson Medical College I made my first successful operation February 5, 1892; since which time I have operated in other cases, and my former assistant, now lecturer on otology, Dr. S. MacCuen Smith, has operated in a large number of cases, both public and private, during my absence in Europe. Some forty of these were clinical cases. In the last edition of the work of Politzer, published in Stuttgart, 1893, on page 276, section 6, "Die Excision des Ganzen Trommelfells und die Extraction des Hammers und Ambouses," he refers to the subject and concludes with a description of the technique of the operation, but gives no opinion of the operation or his cases, nor even states how often he had performed it. He says:

Simrock states that even after complete extirpation of the membrana tympani and hammer a membranous cicatrix forms and fills out the whole opening, which frequently adheres to the opposite wall of the tympanic cavity. Kessel* claims through the tendinous ring at the posterior circumference of the membrana tympani to have secured a permanent opening. According to the experiments of Schwartze† the cicatrization of the opening results from leaving the limbus cartilage. In the cases operated upon by him a serous secretion or suppurative inflammation followed the operation, the treatment of which required several weeks. The improvement in hearing seems to depend upon whether the vibrating conduction is impeded by the hammer-anvil joint or by the stapes; in the latter case no hearing power is secured. The subjective sounds are often lessened, never aggravated.

Lucae removed the membrane and hammer several times; the anvil in 47 cases, 55 times. The result of the operation was in 9 cases a considerable improvement, in 19 a lesser improvement, in 18 a negative result, and in 7 cases an aggravation.

Lucae‡ considers the operation in clinical cases as without danger, but the result so unsatisfactory as to make it advisable to set the procedure aside, pending the establishment of more precise indications.

The excision of the whole membrana tympani together with the hammer, or even hammer and anvil, has been more recently advocated by Sexton‡ on the strength of a considerable number of favorable results at his hands. According to Sexton the operation is indicated in a dry middle-ear catarrh, with a progressive tendency, especially when accompanied by tinnitus and vertigo and when the previous local treatment (catheterism, etc.) has been fruitless. The earlier the operation the better the results.

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*Oest. Ärztl. Vereins-Zeitung, 1879; Arch. f. Ohrenh., Bd. 13.

†Die Chir. Krankh. d. Ohres.

‡Archiv für Ohrenheilkunde, Vol., XXII.

While in Brussels I called to see Dr. Charles Delstanche, the president of the recent Otological Congress held in that city. He contributed by his generous hospitality very much to the happiness and comfort of those who attended it. He stated that his patients still continue to derive much benefit from the use of the massage to the auditory canal and membrana tympani, and uses his condensing syringe and also pure liquid vaseline, or associated with iodoform, especially in subacute cases of otitis media.*

I returned again to Paris in May, 1893, and visited the distinguished otologist, Dr. Lowenberg, president of the Paris Otological Society. I found that he held with great tenacity to the use of the silver Eustachian catheter on account of the risk of infection. These catheters are of three sizes, and in a pamphlet given to us he describes a new method of catheterization of the Eustachian tube, as follows: He states the principal difficulty during the first stage of the operation is the horizontal deviation of the septum. This he obviates by using half of a nasal speculum, so as to guide the catheter and press the septum aside. During the second stage, when the point of the instrument leaves the nasal cavity, it is difficult to tell when we are in front of the pharyngeal orifice of the Eustachian tube. When he thinks that his catheter has arrived at the end of the post-nasal cavity he orders the patient to swallow. If the instrument has not yet passed the nasal cavity the hand holding the instrument feels no shock, but if the instrument has passed into the pharyngeal cavity the soft palate when contracting pushes it sometimes into the tube, or at least displaces it, which movement can be seen and is also felt by the hand. The correct distance once determined, it will be useful to mark it in the instrument. He employs a piece of new rubber tubing for each individual patient to tip the Politzer bag, and inflates the air charged with chloroform vapor. He also adheres to the syringe for the removal of epithelium, scales, etc., seldom employing the probe. He also employs the galvanic cautery for the removal of the polypi and polypoid-like growths. He seldom employs ointments. In this he differs from Politzer, depending chiefly upon alcohol and boracic acid; and he still believes in the special microbes to be found in the pus of suppurative otitis media, as also in furuncles. He seldom operates for diseased mastoid, believing in the use of local applications in the early stage, leaden tubes for ice water and subsequent persistent and careful syringing with Hartmann's intertympanic catheter. He has as yet not employed operative measures for the relief of chronic suppurative and non-suppurative inflammation of the tympanum, waiting, as he states, for further trials.

On my visit to Rome I found great activity in preparation for the International Congress of September, 1893,† and numerous valuable papers will be read in the section of Otology by the distinguished men of that city, more especially Gadnego and De Rossii, who have devoted much labor and careful research to the obscure diseases of the nervous apparatus of the internal ear.

Of the whole number (154) of cases operated upon by my assistant, S. MacCuen Smith, at several of which I was present and assisted him, the youngest was 4 and the oldest 81. The number which either had a continuous or recurrent discharge was 85.

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* In passing it will be interesting to some of my confrères to know that he has since informed me by note that the next Otological Congress is postponed until 1895.

† Which has been postponed to April, 1894, on account of the cholera.

Table of results from excision of the

No.	Age.	Sex.	Discharge.			Tinnitus.	Pain.	Vertigo.	Ear.	Hearing power.			
			Continuous.	Recurrent.	Duration.					Voice.	Tuning fork.	Watch.	Bone conduction.
											In.		
1	16	M.	Yes	No	12 yrs.	No	No	No	Left	Loud 2 ft.	(*)	No.	Normal
2	24	F.	No	Yes	9 yrs.	Yes	Yes	Yes	do	No	No.	No.	do
3	36	F.	Yes	No	19 mos.	Severe	No	No	do	No	No.	No.	½ normal
4	9	F.	No	Yes	7 yrs.	No	No	No	Right	O. C. 1 ft.	No.	No	½ normal
5	81	M.	No	No	No	Severe	Severe	Yes	Both	No	No.	No.	½ normal
6	7	F.	Yes	No	2 yrs.	No	No	No	do	O. C. 2 ft.	No.	No.	do
7	18	F.	No	Yes	13 yrs.	Yes	Yes	No	do	O. C. 3 in.	No.	No.	½ normal
8	14	F.	Yes	No	2½ yrs.	No	No	No	Right	O. C. 1 ft.	2	No.	do
9	7	M.	No	Yes	4½ yrs.	No	Yes	No	do	do	1	1/30	do
10	52	F.	No	No		Severe	No	Severe	Both	L. C. 1 ft.	No.	No.	Slight
11	12	F.	Yes	No	2 yrs.	No	No	No	Right	O. C 2 ft.	1	1/30	Normal.
12	12	M.	Yes	No	3 yrs.	No	No	No	do	O. C. 2½ ft.	½	1/30	do
13	54	M.	Yes	No	3 yrs.	Yes	No	Yes	do	O. C. 1 ft.	No.	No.	do
14	45	M.	No	Yes	7 yrs.	Severe	Severe	Severe	Left	O. C. 3 ft.	No.	No.	do
15	80	M.				30 yrs. severe.	No	20 yrs. severe.	Both	Very L. 1 ft.	No.	No.	½ normal
16	53	F.				10 yrs. severe.	No	3 yrs. severe.	do	O. C. 3 ft.	No.	No.	do
17	62	F.				2 yrs. severe.	No	2 yrs.	do	O. C. ½ ft.	No.	No.	½ normal
18	49	M.				Severe	No	7 mos.	do	O. C. 7 in.	No.	No.	Normal.
19	57	F.				Yes	No	3 mos.	do	O. C. 7 in.	No.	No.	do
20	71	M.				Severe	No	14 yrs.	do	O. C. 2 ft.	No.	No.	½ normal
21	39	M.				Yes	No	5 yrs.	do	O. C. 4 ft	2	No.	Normal.
22	29	M.				2 yrs. severe.	Slight	3 yrs.	do	O. C. 6 ft.	3	No.	do
23	47	M.				do	No	6 yrs.	do	O. C. 13 ft.	No.	No.	do
24	55	M.				Yes	No	12 yrs.	do	O. C. 3 ft.	2½	No.	do
25	57	M.				Yes	No	4 yrs.	do	O. C. 3 ft.	No.	No.	do
26	48	M.				12 yrs. severe.	No	2 yrs.	Left	No	No.	No.	do
27	37	F.				Yes	No	1 yr.	Both	O. C. 6 ft	No.	3 in.	do
28	35	M.				Yes		3 yrs.	Left	O. C. 3 ft.	2	No.	do
29	53	M.				Yes		4 yrs.	do	O. C. 3 ft.	3	No.	do
30	46	F.				Yes		3 yrs.	Both	O. C. 7 ft.	4	No.	do
31	42	F.				Yes		2 yrs.	do	O. C. 9 ft.	7	7 in.	do
32	31	M.				Yes		9 yrs.	do	do	6	2 in.	do
33	36	M.				Yes		1 yr.	Left	do	2	No.	do
34	43	M.				Yes		Yes	do	O. C. 8 ft	1	2 in.	do
35	62	F.				Yes		Yes	Right	O. C. 7 ft.	4	4 in.	do
36	48	M.				Yes		Yes	do	O. C. 12 ft.	3	No.	do
37	43	F.				Yes		Yes	do	O. C. 6 ft.	2	No.	do
38	57	F.				Yes		2 yrs.	do	O. C. 4 ft	3	No.	do
39	56	F.				Yes		No	Left	do	½	No.	do
40	47	M.				Yes		No	do	O. C. 3 ft.	1	No.	do
41	64	M.				Yes	No	No	do	O. C. 5 ft.	2½	No.	do
42	48	M.				Yes	No	1 yr	Right	O. C. 6 ft	3	No.	do
43	47	M.				Yes	No	2 yrs.	Left	O. C. 7 ft.	1	No.	do
44	53	M.				Yes	No	3 yrs	do	O. C. 3 ft	4	1/30	do
45	32	F.				Yes	No	No	do	O. C. 11 ft	3	1/30	do
46	34	M.				Yes	No	No	do	O. C. 10 ft.	1	1/30	do
47	39	M.				Yes	No	No	Both	O. C. 7 ft.	4	1/30	do
48	35	F.				Yes	No	No	Left	O. C. 5 ft.	2	1/30	do
49	47	M.				Yes	No	3 yrs.	Right	O. C. 13 ft.	7	1/30	do
50	64	F.				Yes	No	1 yr.	do	O. C. 4 ft.	1	No.	do
51	47	F.				Yes	No.	4 yrs	do	O. C. 3 ft.	2	1/30	do
52	54	M.				Yes	No	12 yrs.	Left	O. C. 1 ft.	No.	No.	do
53	45	M.				Yes	No	19 yrs.	Both	do	No.	No.	do
54	57	M.				Yes.	No	7 yrs.	do	O. C. 2 ft	No.	No.	¾ normal
55	62	M.				20 yrs. severe.	No	15 yrs severe.	do	L. C. 1 ft	No.	No.	½ normal
56	53	M.				Yes	No	Yes	Left	O. C. 3 ft.	3	3/30	Normal.
57	43	M.				Yes	No	Yes	Right	do	4	1/30	do
58	39	F.				Yes	No	Yes	do	O. C. 4 ft	5	2/30	do
59	40	F.				Yes	No	Yes	do	O. C. 12 ft.	8	2/30	do
60	46	F.				Yes	No	Yes	Left	O. C. 9 ft	4	2/30	do
61	54	F.				Yes.	No.	Yes	do	O. C. 11 ft.	9	No.	do
62	38	M.				Yes	No	Slight	do	O. C. 7 ft.	1	No.	½ normal
63	63	F.				Yes	No	Yes	Both	do	3	No.	do

* Negative.

membrana tympani and ossicles.

Results of operation.				Hearing power.						
Discharge.	Pain.	Tinnitus.	Vertigo.	Voice.	Tuning fork.	Watch.	Time since operation.	Cause of disease.	Operation.	No.
					In.					
No	No	No	No	O. C. 19 ft.	11	$\frac{16}{30}$	3 yrs	Scarlet fever	Mal. and inc.	1
No	No	No	No	O. C. 4 ft.	3	$\frac{7}{30}$	10 mos.	Not known	do	2
No	No	No	No	O. C. 21 ft.	16	$\frac{17}{30}$	4 yrs	La grippe	do	3
No	No	No	No	O. C. 10 ft.	5	$\frac{8}{30}$	7 mos	Measles	do	4
No	No	No	No	O. C. 11 ft.	7	$\frac{13}{30}$	$3\frac{1}{2}$ yrs	Not known	do	5
No	No	No	No	O. C. 6 ft.	9	$\frac{4}{30}$	1 yr	Scarlet fever	do	6
No	No	Slight	No	O. C. 15 ft	12	$\frac{32}{36}$	16 mos.	do	do	7
No	No	No	No	O. C. 10 ft.	5	$\frac{8}{30}$	2 yrs	La grippe	Incus	8
No	No	No	No	O. C. 16 ft.	8	$\frac{12}{30}$	3 yrs	Scarlet fever	do	9
No	No	Slight improvement.	No	O. C. 2 ft.	No	No	$2\frac{1}{2}$ yrs	Not known	Mal. and inc.	10
No	No	No	No	O. C. 12 ft.	4	$\frac{7}{30}$	4 yrs	La grippe	do	11
No	No	No	No	O. C. 18 ft.	9	$\frac{18}{30}$	$3\frac{1}{2}$ yrs	do	Malleus	12
No	No	No	No	O. C. 26 ft.	16	$\frac{23}{30}$	do	do	Incus	13
No	No	No	No	O. C. 5 ft.	9	$\frac{11}{30}$	4 yrs	do	do	14
No	No	No	No	O. C. 4 ft.	2	$\frac{2}{30}$	$3\frac{1}{2}$ yrs	Not known	Inc, and mal., drum intact.	15
No	No	Slight	No	O. C. 2 ft.	1	$\frac{9}{30}$	do	do	do	16
No	No	No	No	do	4	$\frac{3}{30}$	$2\frac{3}{4}$ yrs	do	do	17
No	No	No	No	O. C. 12 ft.	7	$\frac{5}{30}$	1 yr	do	do	18
No	No	Slight	No	do	0	$\frac{1}{30}$	$3\frac{1}{2}$ yrs	do	do	19
No	No	do	No	O. C. 16 ft.	3	$\frac{13}{30}$	do	do	do	20
No	No	do	No	O. C. 9 ft.	11	$\frac{6}{30}$	$1\frac{1}{2}$ yrs	La grippe	do	21
No	No	do	No	O. C. 6 ft.	7	$\frac{3}{30}$	1 yr	do	do	22
No	No	No	No	O. C. 16 ft	5	$\frac{3}{30}$	$2\frac{1}{2}$ yrs	Not known	do	23
No	No	No	No	O. C. 24 ft.	4	$\frac{5}{30}$	2 yrs	do	do	24
No	No	No	No	O. C. 21 ft.	17	$\frac{2}{30}$	3 yrs	do	do	25
No	No	But little improved.	Little improvement	O. C. No	No	No	6 mos	do	do	26
No	No	Slight	No	O. C. 12 ft.	4	$\frac{6}{30}$	7 mos	do	do	27
No	No	do	No	O. C. 19 ft.	7	No	9 mos	do	do	28
No	No	No	No	O. C. 5 ft.	$7\frac{1}{2}$	$\frac{12}{30}$	13 mos	do	do	29
No	Slight	No	No	O. C. 12 ft.	6	$\frac{3}{30}$	5 mos	do	do	30
Slight	do	No	No	O. C. 25 ft.	9	$\frac{15}{30}$	8 mos	do	do	31
No	do	No	No	O. C. 31 ft.	11	$\frac{13}{30}$	16 mos.	do	do	32
No	do	Slight	Slight	O. C. 12 ft.	9	$\frac{13}{30}$	9 mos	do	do	33
No	do	No	do	O. C. 10 ft.	12	$\frac{9}{30}$	9 mos	do	do	34
No	do	No	do	O. C. 13 ft.	11	$\frac{8}{30}$	$6\frac{1}{2}$ mos	do	do	35
No	do	No	do	O. C. 27 ft.	7	$\frac{12}{30}$	7 mos	do	do	36
No	do	No	do	O. C. 9 ft.	8	$\frac{4}{30}$	16 mos	do	do	37
No	do	No	No	O. C. 3 ft.	1	$\frac{2}{30}$	3 mos	do	do	38
No	do	No	No	O. C. 9 ft.	2	No	$2\frac{1}{2}$ mos	do	do	39
No	do	No	No	O. C. 7 ft.	4	$\frac{7}{30}$	18 mos	do	do	40
No	do	No	No	O. C. 12 ft.	1	$\frac{18}{30}$	20 mos	do	do	41
No	do	No	No	O. C. 11 ft.	2	$\frac{3}{30}$	19 mos.	do	do	42
No	do	No	No	O. C. 26 ft.	13	$\frac{4}{30}$	19 mos.	do	do	43
No	do	No	No	O. C. 3 ft.	3	$\frac{2}{30}$	19 mos.	do	do	44
No	do	No	No	O. C. 11 ft.	7	$\frac{2}{30}$	3 yrs	do	do	45
No	do	No	No	O. C. 20 ft.	9	$\frac{7}{30}$	$2\frac{1}{2}$ yrs	do	do	46
No	do	No	No	O. C. 21 ft.	5	$\frac{6}{30}$	4 yrs	do	do	47
No	do	No	No	O. C. 9 ft	17	$\frac{2}{30}$	$2\frac{1}{2}$ yrs	do	do	48
No	do	No	No	O. C. 19 ft.	13	$\frac{12}{30}$	3 yrs	do	do	49
Slight	do	Slight	No	O. C. 27 ft.	5	$\frac{4}{30}$	9 mos	do	do	50
No	No	No	No	O. C. 3 ft.	2	$\frac{2}{30}$	9 mos	do	do	51
No	No	No	No	O. C. 4 ft.	3	$\frac{1}{30}$	13 mos.	do	do	52
No	No	No	No	do	3	No	7 mos	do	do	53
No	No	No	No	O. C. 5 ft.	2	No	4 mos	do	do	54
No	No	No	Slight	O. C. 7 ft.	4	No	4 mos	do	do	55
No	No	No	do	O. C. 2 ft.	3	$\frac{4}{30}$	11 mos	do	do	56
No	No	No	No	O. C. 9 ft.	9	$\frac{15}{30}$	12 mos	do	do	57
No	No	No	Slight	O. C. 12 ft.	8	$\frac{9}{30}$	9 mos	do	do	58
No	No	Yes	do	O. C. 16 ft.	9	$\frac{18}{30}$	7 mos	do	do	59
No	No	Yes	No	O. C. 20 ft.	12	$\frac{6}{30}$	16 mos	do	do	60
No	No	No	No	O. C. 9 ft.	9	$\frac{1}{30}$	3 mos	do	do	61
No	No	Slight	Slight	O. C. 6 ft	1	$\frac{1}{30}$	2 yrs	do	do	62
No	No	do	do	O. C. 8 ft.	2	No	1 yr	do	do	63

O. C.=Ordinary conversation. L. C.=Loud conversation.

Table of results from excision of the membrana

No.	Age.	Sex.	Discharge.			Tinnitus.	Pain.	Vertigo.	Ear.	Hearing power.			
			Continuous.	Recurrent.	Duration.					Voice.	Tuning fork.	Watch.	Bone conduction.
											In.		
64	42	M.	.....	.....	.....	Yes	No	Yes	Right	O. C. 5 ft.	2¼	No.	½ normal
65	47	M.	.....	.....	.....	Yes	No	Slight	do	O. C. 12 ft.	1	No.	Normal.
66	51	M.	.....	.....	.....	Yes	No	Slight	Left	O. C. 1 ft.	3	No.	do
67	50	M.	.....	.....	.....	Yes	No	Slight	Right.	do	1	No.	½ normal
68	57	M.	.....	.....	.....	Yes	No	Slight	do	O. C. 2 ft.	2	1/30	do
69	48	F.	.....	.....	.....	Yes	No	Slight	do	O. C. 3 ft.	2	1/30	½ normal
70	49	M.	.....	.....	.....	Yes	No	No	Left	O. C. 4 ft.	1	3/30	do
71	39	F.	.....	.....	.....	Yes	No	No	do	do	4	3/30	do
72	33	F.	.....	.....	.....	Yes	No	No	Right	O. C. 2 ft.	3	3/30	do
73	41	F.	.....	.....	.....	Yes	No	No	do	do	5	3/30	do
74	44	M.	.....	.....	.....	Yes	No	No	do	O. C. 4 ft.	2	3/30	do
75	38	F.	.....	.....	.....	Yes	No	Yes	do	do	1	No.	Normal.
76	61	M.	.....	.....	.....	Yes	No	Yes	Left	O. C. 4 ft.	2	1/30	Normal.
77	58	M.	.....	.....	.....	Yes	No	No	do	O. C. 3 ft.	1	3/30	do
78	59	F.	.....	.....	.....	Yes	No	No	do	O. C. 6 ft.	1	3/30	do
79	49	F.	.....	.....	.....	Yes	No	No	Right	O. C. 2 ft.	1	No.	½ normal
80	44	F.	.....	.....	.....	Yes	No	Yes	Left	O. C. 3 ft.	3	No.	Normal.
81	35	M.	.....	.....	.....	Yes	No	Yes	Right	O. C. 4 ft.	2	No.	½ normal
82	64	M.	.....	.....	.....	10 yrs. severe.	No	9 yrs. severe.	Both	L. C. 1 ft.	No.	No.	do
83	74	M.	.....	.....	.....	12 yrs. severe.	No	4 yrs. severe.	do	L. C. 2 ft.	No.	No.	½ normal
84	67	M.	.....	.....	.....	9 yrs. severe.	No	3 yrs. severe.	do	L. C. 1 ft.	No.	No.	½ normal
85	4	F.	Yes	.....	1 yr.	No	No	No	do	O. C. 8 ft.	2	No.	Normal
86	7	F.	Yes	.....	3 yrs.	No	No	No	do	do	4	No.	do
87	9	M.	Yes	.....	2 yrs.	No	No	No	do	O. C. 6 ft.	2	3/30	do
88	18	F.	.....	Yes	7 yrs.	No	Yes	No	Right	O. C. 16 ft.	9	18/30	do
89	4	F.	Yes	.....	18 mos.	No	No	No	do	O. C. 1 ft.	4	No.	do
90	5	F.	Yes	.....	do	No	No	No	do	do	2	No.	do
91	23	F.	.....	Yes	17 yrs.	Yes	Yes	No	do	O. C. 7 ft.	1	No.	do
92	13	F.	Yes	.....	9 yrs.	No	No	No	do	O. C. 4 ft.	4	No.	do
93	27	M.	.....	Yes	12 yrs.	Yes	Yes	No	do	O. C. 7 ft.	3	3/30	do
94	19	M.	Yes	.....	18 mos.	No	No	No	Left	O. C. 4 ft.	1	3/30	do
95	28	F.	.....	Yes	11 yrs.	Yes	Yes	No	Right	O. C. 3 ft.	1	No.	do
96	22	M.	Yes	.....	6 yrs.	No	No	No	do	O. C. 9 ft.	3	3/30	do
97	7	M.	Yes	.....	2 yrs.	No	No	No	do	O. C. 4 ft.	4	No.	do
98	6	F.	Yes	.....	9 mos.	No	Slight	No	do	O. C. 7 ft.	1	No.	do
99	18	M.	Yes	.....	10 mos.	No	No	No	do	O. C. 6 ft.	2	No.	do
100	12	M.	Yes	.....	12 mos.	No	No	No	Both	O. C. 12 ft.	7	3/30	do
101	4	M.	Yes	.....	9 mos.	No	Yes	No	Left	O. C. 2 ft.	3	No.	do
102	9	F.	Yes	.....	2 yrs.	No	Yes	No	do	O. C. 6 ft.	5	No.	do
103	49	F.	.....	Yes	20 yrs.	Yes	Yes	Yes	do	O. C. 1 ft.	No.	No.	do
104	27	F.	.....	Yes	17 yrs.	Yes	Yes	Yes	Right	O. C. 2 ft.	No.	No.	do
105	12	M.	Yes	.....	4 yrs.	No	No	No	do	O. C. 4 ft.	4	3/30	do
106	14	F.	Yes	.....	do	No	No	No	do	O. C. 8 ft.	7	3/30	do
107	26	M.	Yes	.....	3 yrs.	No	No	No	do	O. C. 3 ft.	5	3/30	do
108	32	M.	Yes	Yes	24 yrs.	Yes	Yes	Yes	Both	O. C. 1 ft.	No.	1/30	do
109	19	F.	.....	.....	1 yr.	No	No	No	Left	O. C. 9 ft.	5	3/30	do
110	7	M.	Yes	Yes	2 yrs.	No	No	No	do	O. C. 12 ft.	8	3/30	do
111	28	F.	Yes	Yes	16 yrs.	Yes	No No	No No	do	O. C. 4 ft	2	1/30	do
112	22	M.	Yes	.....	9 yrs.	No	No	No	do	O. C. 6 ft.	3	4/30	do
113	31	M.	.....	Yes	12 yrs.	Yes	No	No	do	O. C. 3 ft.	1	3/30	do
114	26	M.	.....	Yes	do	Yes	No	No	Right	O. C. 8 ft.	7	3/30	do
115	18	F.	Yes	.....	4 yrs.	No	No	No	do	O. C. 6 ft.	9	3/30	do
116	24	M.	Yes	.....	9 yrs.	No	No	No	Left	O. C. 3 ft.	2	3/30	do
117	19	F.	Yes	.....	2 yrs.	No	No	No	Both	O. C. 6 ft.	1	No.	do
118	12	F.	Yes	.....	1 yr.	No	No	No	Left	O. C. 11 ft.	1	No.	do
119	14	F.	Yes	.....	3 yrs.	No	No	No	do	O. C. 7 ft.	3	3/30	do
120	11	F.	Yes	.....	6 yrs.	No	No	No	Both	do	1	No.	do
121	7	M.	Yes	.....	5 yrs.	No	No	No	do	O. C. 3 ft.	1	No.	do

O. C. = Ordinary conversation.

tympani and ossicles—Continued.

Results of operation.				Hearing power.						
Discharge.	Pain	Tinnitus.	Vertigo	Voice.	Tuning fork.	Watch.	Time since operation.	Cause of disease.	Operation.	No.
					In.					
No	No	Slight	Slight	O. C. 5 ft	1	No	3 yrs	Not known	Inc. and mal. drum intact.	64
No	No	do	Not much improved.	O. C. 11 ft	2	No	7 mos	do	do	65
No	No	No	do	O. C. No	2	No	12 mos	do	do	66
No	No	Slight	do	O. C. No	No	No	3 mos	do	do	67
No	No	No	No	O. C. 2 ft	2	$\frac{1}{30}$	3 mos	do	do	68
No	No	No	No	O. C. 4 ft	4	$\frac{2}{30}$	4 mos	do	do	69
No	No	No	No	O. C. 3 ft	3	$\frac{1}{30}$	8 mos	do	do	70
No	No	No	No	O. C. 6 ft	4	$\frac{2}{30}$	10 mos	do	do	71
No	No	Slight	No	O. C. 4 ft	4	$\frac{2}{30}$	14 mos	do	do	72
No	No	do	No	O. C. 8 ft	7	$\frac{3}{30}$	18 mos	do	do	73
No	No	do	No	O. C. 7 ft	2	$\frac{1}{30}$	9 mos	do	do	74
No	No	No	No	O. C. 4 ft	2	$\frac{2}{30}$	3 yrs	do	do	75
No	No	No	No	O. C. 4 ft	2	No	2½ yrs	do	Mal. and inc., drum intact.	76
No	No	No	Slight	O. C. 6 ft	4	No	11 mos	do	do	77
No	No	No	No	O. C. 12 ft	5	$\frac{6}{30}$	3 yrs	do	Mal. and inc.	78
No	No	No	do	O. C. 1 ft	2	$\frac{2}{30}$	1 yr	do	do	79
No	No	No	do	O. C. 8 ft	4	No	2 yrs	do	do	80
No	No	Slight	do	O. C. 8 ft	3	No	2 yrs	do	Inc., drum intact.	81
No	No	No	do	O. C. 1 ft	½	No	3 yrs	do	do	82
No	No	No	No	O. C. 9 ft	9	$\frac{6}{30}$	12 mos	do	Mal. and inc., drum intact.	83
No	No	No	Slight	O. C. 12 ft	8	$\frac{5}{30}$	9 mos	do	do	84
No	No	Yes	do	O. C. 16 ft	9	$\frac{12}{30}$	7 mos	do	do	85
No	No	Yes	No	O. C. 20 ft	12	$\frac{5}{30}$	16 mos	do	do	86
No	No	No	No	do	9	$\frac{3}{30}$	3 mos	do	do	87
No	No	Slight	Slight	O. C. 6 ft	1	$\frac{1}{30}$	2 yrs	do	do	88
No	No	do	do	O. C. 8 ft	2	No	1 yr	do	do	89
No	No	do	do	O. C. 5 ft	1	No	3 yrs	do	do	90
No	No	do	Not much improved.	O. C. 11 ft	2	No	7 mos	do	do	91
Slight	No	No	do	O. C. No	2	No	12 mos	do	do	92
No	No	Slight	do	O. C. No	No	No	3 mos	do	do	93
No	No	No	No	O. C. 2 ft	2	$\frac{1}{30}$	3 mos	do	do	94
Slight	No	No	No	O. C. 4 ft	3	$\frac{2}{30}$	4 mos	do	do	95
No	No	No	No	O. C. 3 ft	4	$\frac{1}{30}$	8 mos	do	do	96
No	Slight	No	No	O. C. 6 ft	4	$\frac{2}{30}$	10 mos	do	do	97
No	No	Slight	No	O. C. 4 ft	4	$\frac{2}{30}$	14 mos	do	do	98
No	No	do	No	O. C. 8 ft	7	$\frac{4}{30}$	18 mos	do	do	99
No	No	do	No	O. C. 7 ft	2	$\frac{1}{30}$	9 mos	do	do	100
No	No	No	No	O. C. 4 ft	2	$\frac{2}{30}$	3 yrs	do	do	101
No	No	No	No	do	2	No	2½ yrs	do	do	102
No	No	No	Slight	O. C. 6 ft	4	No	11 mos	do	do	103
No	No	No	No	O. C. 12 ft	5	$\frac{6}{30}$	3 yrs	do	Mal. and inc.	104
No	No	No	Slight	O. C. 1 ft	2	$\frac{2}{30}$	1 yr	do	do	105
No	No	No	do	O. C. 8 ft	4	No	2 yrs	do	do	106
No	No	Slight	do	do	3	No	2 yrs	do	Inc., drum intact.	107
No	No	No	do	O. C. 1 ft	½	No	3 yrs	do	do	108
No	No	No	No	O. C. 1 ft	1	No	3 yrs	do	do	109
No	No	Slight	No	L. C. 3 ft	1½	No	do	do	do	110
Slight	No	No	No	O. C. 7 ft	4	$\frac{1}{30}$	12 mos	Scarlet fever	Drum, mal. and inc.	111
No	No	No	No	do	3	$\frac{1}{30}$	4 mos	do	do	112
Slight	No	No	No	O. C. 12 ft	3	$\frac{5}{30}$	8 mos	do	do	113
No	No	No	No	O. C. 27 ft	11	$\frac{6}{30}$	2 yrs	do	do	114
No	No	No	No	O. C. 12 ft	5	$\frac{4}{30}$	4 yrs	do	do	115
No	No	No	No	do	12	$\frac{6}{30}$	do	do	do	116
No	No	No	No	O. C. 18 ft	4	$\frac{2}{30}$	3 yrs	Measles	do	117
No	No	No	No	O. C. 12 ft	9	$\frac{8}{30}$	2 yrs	Scarlet fever	do	118
No	No	No	No	O. C. 9 ft	7	$\frac{12}{30}$	1 yr	do	do	119
No	No	No	No	O. C. 7 ft	9	$\frac{12}{30}$	18 mos	do	do	120
No	No	No	No	O. C. 6 ft	4	$\frac{2}{30}$	13 mos	do	do	121

L. C. = Loud conversation.

Table of results from excision of the membrana

No.	Age.	Sex.	Discharge.			Tinnitus.	Pain.	Vertigo.	Ear.	Hearing power.			
			Continuous.	Recurrent.	Duration.					Voice.	Tuning fork.	Watch.	Bone construction.
											In.		
122	5	F.	Yes	------	2 yrs	No	No	No	Both	O. C. 2 ft	2	No	Normal
123	6	F.	Yes	------	1½ yrs	No	No	No	do	O. C. 8 ft	2	No	do
124	8	M.	Yes	------	2 yrs	No	No	No	do	O. C. 1 ft	1	No	do
125	11	M.	Yes	------	do	No	No	No	Right	O. C. 3 ft	3	$\frac{3}{5}$	do
126	16	F.	Yes	------	18 mos.	Yes	No	No	do	do	4	$\frac{1}{5}$	do
127	10	F.	Yes	------	11 mos.	No	No	No	do	O. C. 4 ft	2	$\frac{3}{5}$	do
128	8	F.	Yes	------	16 mos.	No	No	No	Left	O. C. 2 ft	1	$\frac{1}{5}$	do
129	6	M.	Yes	------	22 mos.	No	No	No	Right	O. C. 1 ft	6	$\frac{1}{5}$	do
130	10	F.	Yes	------	23 mos.	Yes	No	No	Left	do	4	No	do
131	13	M.	Yes	------	3 yrs	No	No	No	do	O. C. 4 ft	1	No	do
132	5	M.	Yes	------	8 mos.	No	No	No	do	O. C. 8 ft	1	No	do
133	26	M.	------	Yes	19 yrs.	Severe 8 yrs.	Yes	Yes	Both	O. C. 1 ft	3	No	do
134	16	M.	------	------	4 yrs	No	No	No	Right	O. C. 6 ft	2	$\frac{3}{5}$	do
135	31	F.	------	Yes	21 yrs	Severe 12 yrs.	Yes	Severe 9 yrs.	Both	O. C. 4 ft	4	$\frac{3}{5}$	do
136	21	M.	------	Yes	8 yrs	Severe 8 yrs.	Yes	Yes	Right	O. C. 3 ft	2	$\frac{1}{5}$	do
137	8	M.	Yes	------	2 yrs	No	Yes	No	Left	O. C. 1 ft	1	No	do
138	11	F.	Yes	------	4 yrs	No	Yes	No	do	O. C. 8 ft	1	No	do
139	9	F.	Yes	------	6 yrs	No	Yes	No	do	O. C. 2 ft	1	No	do
140	6	M.	Yes	------	1 yr	No	Yes	No	do	O. C. 3 ft	3	$\frac{1}{5}$	do
141	8	F	Yes	------	3 yrs	No	Yes	No	Right	O. C. 8 ft	1	$\frac{3}{5}$	do
142	12	M.	Yes	------	8 mos.	No	Yes	No	do	O. C. 2 ft	No	No	do
143	9	M.	Yes	------	3 yrs	No	Yes	No	do	O. C. 1 ft	No	No	do
144	7	M.	Yes	------	2 yrs	No	Yes	No	Left	do	No	$\frac{1}{5}$	do
145	7	M.	Yes	------	1 yr	No	Yes	No	Both	do	No	No	do
146	8	F.	Yes	------	4 yrs	No	Yes	No	do	O. C. 3 ft	No	No	do
147	6	F.	Yes	------	3 yrs	No	Yes	No	do	O. C. 2 ft	No	No	do
148	4	M.	Yes	------	2 yrs	No	Yes	No	do	do	No	No	do
149	3	F.	Yes	------	1 yr	No	Yes	No	do	do	No	No	do
150	3	F	Yes	------	2 yrs	No	Yes.	No	do	O. C. 1 ft	1	$\frac{3}{5}$	do
151	5	F.	Yes	------	3 yrs	No	Yes	No	do	do	2	$\frac{3}{5}$	do
152	8	F.	Yes	------	4 yrs	No	Yes	No	do	O. C. No	2	No	do
153	7	F.	Yes	------	5 yrs	No	Yes	No	do	do	3	No	do
154	6	F.	Yes	------	2 yrs	No	Yes	No	do	do	2	No	do

O. C.=Ordinary conversation.

tympani and ossicles—Continued.

Results of operation.				Hearing power.			Time since operation.	Cause of disease.	Operation.	No.
Discharge.	Pain.	Tinnitus.	Vertigo.	Voice.	Tuning fork.	Watch.				
					In.					
No	No	No	No	O. C. 4 ft	2	9/30	10 mos.	Scarlet fever	Drum, mal. and inc.	122
No	No	No	No	O. C. 18 ft.	5	11/30	11 mos.	do	do	123
No	No	No	No	O. C. 2 ft.	4	10/30	8 mos.	Diphtheria	Drum and malleus.	124
No	No	No	No	O. C. 3 ft.	8	2/30	18 mos.	Scarlet fever	do	125
No	No	No	No	O. C. 10 ft.	4	5/30	13 mos.	do	do	126
No	No	No	No	O. C. 8 ft.	3	7/30	3 yrs.	do	do	127
No	No	No	No	O. C. 3 ft.	6	3/30	2 yrs.	do	do	128
No	No	No	No	O. C. 2 ft.	12	12/30	9 mos.	do	do	129
No	No	No	No	O. C. 3 ft.	6	18/30	6 mos.	do	do	130
No	No	No	No	O. C. 5 ft.	4	3/30	13 mos.	do	do	131
No	No	No	No	O. C. 9 ft.	2	4/30	1 mo.	do	do	132
Slight	Slight	No	No	O. C. 13 ft.	12	2/30	3 mos.	do	do	133
No	No	No	No	O. C. 5 ft	2	9/30	20 mos.	do	do	134
Slight	Slight	Slight	Slight	O. C. 11 ft.	3	4	7 mos.	do	do	135
No	No	No	No	O. C. 7 ft.	1	2/30	7 mos.	do	do	136
No	No	No	No	O. C. 3 ft.	2	No	9 mos.	do	do	137
No	No	No	No	O. C. 18 ft.	4	No	4 mos.	do	do	138
No	No	No	No	O. C. 6 ft.	3	No	5 mos.	Measles	do	139
No	No	No	No	do	3	No	7 mos.	do	do	140
No	No	No	No	do	3	No	6 mos.	do	do	141
No	No	No	No	O. C. 9 ft.	2	1/30	3 mos.	Diphtheria	do	142
No	No	No	No	O. C. 2 ft.	1	3/30	2 mos.	do	do	143
No	No	No	No	O. C. 4 ft.	3	3/30	1 mo.	do	do	144
No	No	No	No	O. C. 12 ft.	8	13/30	do	do	do	145
No	No	No	No	O. C. 4 ft.	5	2/30	do	do	no	146
No	No	No	No	O. C. 3 ft.	3	5/30	do	Mumps	do	147
No	No	No	No	O. C. 2 ft.	2	5/30	do	do	do	148
No	No	No	No	O. C. 6 ft	6	No	4 mos.	do	do	149
No	No	No	No	O. C. 10 ft.	3	5/30	do	do	do	150
No	No	No	No	O. C. 2 ft.	8	2/30	9 mos.	do	do	151
No	No	No	No	O. C. 3 ft.	7	3/30	1 yr.	do	do	152
No	No	No	No	do	9	4/30	11 mos.	do	do	153
No	No	No	No	O. C. 4 ft.	3	2/30	9 mos.	do	do	154

In the foregoing list of 154 operations it will be found that from cases 15 to 84 inclusive we record 691 patients presenting the non-suppurative variety of middle-ear disease. Many of these patients suffered from distressing tinnitus: severe pain, staggering, vertigo, and marked impairment of hearing, while others complained of one or more of these same symptoms in a much less degree. Their ages range from 21 to 81 years. The time in which the patients suffered from one or more of these symptoms varies from two to forty years, while the time elapsing since the date of operation is from three months to four years. The improvement in tinnitus and vertigo has been in many cases most striking and satisfactory, notwithstanding the little hope that could be offered for their relief in some of the cases before operation. The probable improvement of hearing in this class of cases is of course not marked by so many favorable possibilities as in the suppurative variety and yet a perusal of the carefully recorded results will, we think, be convincing that the operation in selected cases is now justifiably demanded.

Part Second.

In chronic suppurative disease of the middle ear, after all ordinary measures have failed, the excision of the membrana tympani and ossicles is resorted to for relief or cure of carious or necrosed bone or diseased tissues, causing mechanical obstruction to the entrance of sound, and is now a well-established rule of practice as well as a decided advance in aural surgery. In non-suppurative or chronic middle-ear inflammation the operation has received the term "otosclerectomy" (οὖς, ὠτός, ear; σκληρός, hard; ἐκτόμη, excision), or the surgical removal of all or part of the sclerosed and anchylosed conductors of sound. The operation has received the sanction of the majority of the aurists of the United States and many in Germany for properly selected cases. Now and then we meet with cases of such failures as occur with our best surgeons in the best diagnosed and selected cases. "To err is human," etc., and in our experience of many years in the practice of the profession we have witnessed some errors and have received authentic reports of sad results in general surgery from others. Not only do they occur in the hands of the tyro, but in those of professors and hospital surgeons of our cities. In properly selected cases of non-suppurative or chronic middle-ear inflammation our success has been good, when we find a patient with the obstruction anywhere between the thickening and adhesions of the membrana tympani or anchylosis of the malleus with the incus. It is almost always necessary to perform a preliminary operation by a removal of an oval piece of the drum with the malleus. When we find that this opening improves the hearing or relieves the tinnitus and vertigo, we then complete the operation by removing the incus. If there be any dry, progressive sclerosis affecting the stapes, it has been advised to make a long incision in the membrana tympani posterior to the malleus, and to use traction on the incudo-stapedial joint. If these are not effectual in removing the annoying symptons, then it will be safe to resort to the full operation, i. e., excision of the membrana tympani and ossicles. In our hands even sclerosis has been stopped by the operation. See case which stood the test of two years, as follows:

The most recent one was a lady of 38 years. She was profoundly deaf, only hearing the watch, of 60 inches, on close contact on either ear. There was pain and great tinnitus, with vertigo. Both ears were operated upon May 22, 1892. The left ear first, the right ear soon after, as at first she did not experience much benefit. The parts continued so patulous that she breathed through her Eustachian tube. In May, 1893, her hearing had improved to 8 inches for the watch on the right and 4½ inches on the left. She can hear an ordinary voice, by first calling her attention to it, at 25 feet, and is no longer considered very deaf by her friends. The progress in this case was very slow, being almost one year before decided improvement took place.

The following is a much more satisfactory case:

Excision of the membrana tympani and handle of malleus in otitis media catarrhalis chronica, with improvement of hearing and removal of the tinnitus and vertigo: E. H. K., aged 46, a daughter of one of our deceased county judges, was left dependent upon her own exertions for a livelihood. When she presented herself, June 9, 1891, at our office for treatment she was profoundly deaf from otitis media catarrhalis chronica of many years' duration. She had also suffered from chronic rhinitis, with nasal hypertrophies, all of which had been removed and everything done for her without improving her hearing. On testing her hearing by watch, of 60 inches, it was not heard on close contact on the right ear, and only 3 inches on he left.

Miss E. H. K., *status præsens*, June 18, 1891: Right ear, membrana tympani thickened; the short process prominent; the handle attached to the promontory and the whole malleus was twisted on its axis (torquirt) Gruber; the air enters the tympa um: H. W. close (pressed contact); tuning fork, full C; Reiner's test shows the auditory nerve normal; bone conduction good; tinnitis (from pressure), escaping steam, hissing, and roaring. Left ear the better looking, taking all points in topography of the membrana tympani, etc.; conditions the same as in fellow-ear; air enters the tympanum full and well; but one section (posterior and superior) moves from autoinflation; H. W. = 3 inches, Reiner's test negative; the auditory canal was relaxed and dry, with a general congestive condition; bled on rough contact of cotton. A radical operation was proposed, excision of the membrana tympani and malleus; and she consented, as she had great difficulty in being understood in her business.

After suitable preparation the patient was admitted into the woman's surgical ward at the Jefferson Medical College Hospital on Friday, February 5, 1892. She was operated upon on Saturday, the 6th, Dr. Eads, one of the surgical assistants, administering the ether by carefully dropping it on a folded towel until there had been employed some 4 ounces, but she was not profoundly unconscious. We then directed her to be given a few whiffs of chloroform, which had the desired effect, but in a few seconds respiration became embarrassed, and the chloroform was withdrawn: artificial respiration was performed, and after prompt recovery the ether was again resumed and the operation performed. The first difficulty was the great relaxation of the lining membrane of the auditory canal, which was pushed before the Gruber speculum. A bivalve was then tried with no better results. A large-sized ordinary Politzer speculum was then employed with the illumination of the electric light. Another difficulty in her case was that after performing the double incision the canal was filled with blood, which was very much in the way during the whole operation. In cutting around the malleo-incudal joint found it very firmly anchylosed, so that it could not be removed by a strong pair of forceps; so, after using all the force considered justifiable, Dr. Smith, who assisted me, tried to remove it, but he had no better success, although he found the section complete all around the membrana tympani, and also the double incision running up to the membrana flaccida. After removing the membrana and handle and part of the malleus and cleansing the parts and blowing iodoform powder into the canal, plugging it with iodoform cotton, the patient was removed from the operating room to the ward. She had considerable nausea from the anæsthetic, but had no bad symptoms, and was able to leave the ward on the ninth day after the operation, greatly improved in hearing, being able to hear with that ear when the other was closed.

On examination ten days later she stated that everything sounded loud to her. She also heard the watch half an inch from the ear which before she could not hear on close contact. The following is her own statement, she being well educated and intelligent: "Am both pleased and surprised with the result of the operation, for although I was not very sanguine of deriving much benefit from it, at least I would not let myself hope too much, fearing a disappointment; yet I was willing to try. From the very first day after the operation I found an improvement. Voices at the other side of the room were loud and unnatural, but I could not distinguish the words. The footsteps which before seemed to move noiselessly along the bare floors, now seemed like the tread of heavy shoes. I can now hear the voice and speech given in an ordinary tone and without being very near the speaker. The noises of wagons and cars in the street are very loud and sound as if the ground was hollow. All sounds and voices seem loud and unnatural, excepting music, which has lost none of its sweetness. All my friends are surprised and pleased with the improvement in my hearing, and say it is no effort to make me hear them now. This is all without my ear being entirely healed, and filled with cotton wool. I am now waiting to hear what improvement I will find in being able to hear a sermon or address in public. I have tried to give you a very cor-

rect account. I have a sound in my ear like puffing of steam, always worse after coming upstairs, but sometimes it is so faint that I forget it."

The patient presented herself on twelfth day, and we removed considerable dried blood. Tested her hearing and found her progressing most favorably. Again, on February 17, my patient reported as follows: "Hearing continues good and the harsh sounds are disappearing." Tested her hearing in ordinary conversation, with her face turned from me, and she heard me distinctly at a distance of 13 feet.

Two weeks later she reports: "Yesterday was the first test I have made of my hearing, since the operation, in church, and it was a complete surprise to me, for I had never imagined that I should find such great improvement. I had no difficulty in hearing the lessons read, and in fact all of the service, and I was able to join in myself, and that is what I have not been able to do for a great many years—fifteen or sixteen I think—and the great volume of sound that came from the organ almost overwhelmed me, I was going to say—perhaps that is almost too strong a word—yet I have often been in doubt whether the organ was being played at all, it would be so indistinct at times, and yesterday the difference was so great. I find a great improvement in many ways. I get along much better at work, and my friends do not have to strain their voices to make me hear."

One month and five days after the operation, since her last visit, she reports: "Have had some pain in the ear, but on blowing the nose forcibly some blood passed, and the pain disappeared with no return since. Visited a friend in the country on Sunday, who stated that it was like a revelation, the restoration of my hearing. At a business meeting I was able to hear all that was going on, when formerly I heard not a word."*

Two years after the operation, June, 1893, hearing continues perfect in the ear operated upon; new membrane formed has been examined by Dr. S. MacCuen Smith, Dr. C. S. Turnbull, and Dr. C. M. Thomas; all confirm the good results in her case.

In proliferous disease of the middle ear, and when all ordinary and extraordinary measures, as massage, vaseline, Eustachian bougie and catheter, vibratory treatment, etc., have failed, we are fully justified in opening the drum, and excising the head of or the entire malleus, but it has not always been found necessary to remove the incus and stapes. In cases of severe pain in the ear of an obscure nature, with a dreadful feeling of pressure, cases of which have been seen at the aural clinic, much relief of a permanent character has been afforded the patients by opening the drum and disarticulating the malleus. On examination there has been found diseased bony structure which giving no other indication on the surface. We have found similar disease in the mastoid region, where in two cases an opening was found in the bone large enough to admit the tip of the forefinger. We have never, as yet, known of a death from this operation, but cases have been reported where the hearing power has been made worse. Cases accompanied with atrophy or paralysis of the auditory nerve should not be operated upon. Again, great care must be taken not to injure the Fallopian canal with the incus hook. Children can be operated upon, and even old men have had their hearing restored for ordinary conversation, also experiencing great relief from tinnitus and vertigo. As a matter of course, the older the individual, the less chance of restoration to good hearing. Yet cases aged 60 and even 81 years have been operated upon with good success.

We are all liable to accidents, yet much can be done to prevent them by great care in our manipulations in so limited a space as we have to operate. The use of antisepsis, a good electric light, and a proper clip for a lens on the back of the forehead mirror; this is necessary for presbyopes.

The mobilization and extraction of the stapes was first proposed by Ricardo Botey (Berlin Congress, 1890) and modified and performed by Miot and Boucheron. An incision was made on the outer periphery and the stapes was extracted by a Palet hook. Kessel and Botey employed extraction through the fenestra ovalis in

* Progress of Otology, Annals of Ophthalmology and Otology, April 1, 1892.

anchylosed and fixed stapes. Still later, C. L. Jack* reported 16 cases; 5 for chronic middle-ear catarrh, in which there was a remarkable improvement in a number of the cases. Then we have the synechotomy, or section of the stapes suggested by Schwartze and published in the transactions of the congress at Basle. (In Politzer's work are figured the instruments for the performance of these operations, pp. 273–275; Figs. 144, 145, and a careful description of the operation.) The most recent report on the removal of the stapes is by Clarence J. Blake (Boston)† of 4 cases operated upon under a solution of cocaine. His results have not been very encouraging; 2 were slightly improved, and in 2 there was no improvement. The operation for excision of the stapes has only been performed in a very few cases in Philadelphia, owing to the prolonged staggering vertigo which followed them.

Schwartze's contraindications to operation for removal of the drumhead, hammer, and anvil: (1) Excessive deafness so great as to require shouting into the ear of the patient. (2) When inflammation of the middle ear produces not even temporary improvement in hearing or tinnitus. (3) When puncture of the drum head improves neither tinnitus nor hearing, never do a double operation and do the operation only in the worst ear. Operations should only be performed under these conditions. Our own conclusions are as follows: When a patient is so deaf as not to hear the voice close to the ear or a watch of 60 inches applied in contact, we would reject such as unfitted for the radical operation, but the preliminary one can be performed. If the suppurative process has continued for a very long period, especially in a scrofulous or consumptive individual, it is best to give a guarded opinion of the success of the operation, as structural lesions of the internal ear are apt to occur.

The demonstrations shown by Prof. Politzer, besides their scientific interest, aid us in understanding why in many cases our therapeutic efforts are not crowned with success. You know, gentlemen, that in recent years various attempts have been made to accomplish the extraction of the stapes for the purpose of diminishing the degree of deafness. As a matter of course, such an operation is only possible as long as the affection has not produced a condition of anchylosis. When the plate of the stapes is once fixed to the fenestra ovalis, or even partially fixed, an operation becomes impossible, for the arch of the stapes would break off under the least traction. But even should our operation appear to bring immediate relief we can hardly hope for a permanent result in all cases, if we bear in mind the anatomical changes which we have observed in the specimens shown by Prof. Politzer. As we have seen that the osseous proliferation originates in the capsule, is progressive, and extends toward the oval window, almost invariably producing complete occlusion of the fenestra, even an early extraction of the stapes would hinder the progress of the disease in the form of anchylosis here described.

DISCUSSION.

Dr. M. Thorner. The favorable results obtained by Dr. Turnbull in a number of cases of removal of the membrana tympani and some of the ossicles are certainly very remarkable. I am inclined to think that in his cases, as well as in those reported by some other gentlemen, conditions prevailed more favorable to obtaining good results than in cases reported by some observers who greatly disfavor these operations. I think that we may expect, in cases of simple adhesions,

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*Transactions American Otological Society, 1892.

†Archives of Otology, April, 1893, p. 196.

better results than in those of complete anchylosis. If the mallelus has been removed, it appears to be rather risky to leave the incus where it possibly might do harm, while its presence can not aid any longer in the mechanism of the sound-transmitting apparatus. As to the removal of the stapes, there is at present scarcely enough evidence to formulate distinct indications for this operation. But it stands to reason, especially if we consider the light thrown upon this question by yesterday's demonstrations of Prof. Politzer, that in a great majority of cases we can not expect to obtain any permanent results by the operation of stapedectomy. I would like to ask Dr. Turnbull in what position he places his patient during the operation. May not the position, either the sitting or half reclining, have been responsible for the embarrassment of respiration, observed in the one patient, as soon as chloroform was given?

Dr. HOBBY. Is it not possible that many of the failures in operations upon the middle ear are due to labyrinthic disease having been previously developed?

Dr. MALONEY. I would like to ask Dr. Turnbull whether the two successful cases reported in the paper read by him represented the success obtained in the entire number of operations named by him in the first part of his paper? My method of treatment compels me to admit the necessity for excision of the membrana and ossicles only in cases showing caries, and not as a means of improving the hearing. The limited success following this operation for improving audition I think sustains me in my view.

Dr. TURNBULL. In reply to the question of the secretary, I am not sure of the removal of the incus, and therefore did not state that it was removed. I always operate by placing the patient on a bed or lounge on the side. A number of chronic cases are reported in Dr. Smith's table operated at the clinic of the Jefferson Medical College Hospital.

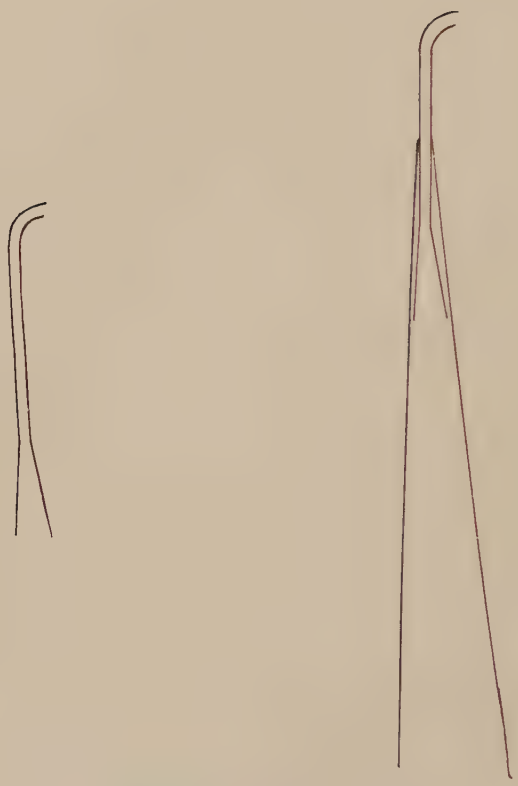
FOCUSING EAR TRUMPET.

By EDMUND D. SPEAR, M. D.

The large number of cases of incurable diseases of the ear, accompanied by deafness for conversational tones, makes it necessary for the aurist to prescribe some form of acoustic apparatus as an aid to hearing. The unsatisfactory character of the ordinary mechanical aids is, perhaps, the cause of the negligence of aurists in regard to this matter. In Burnett's recently published System of Diseases of the Ear, Nose, and Throat an article on "Acoustic aid to the deaf" will be found, in which I make suggestions regarding the use of instruments for patients with defective hearing, and I shall quote some of them in this paper.

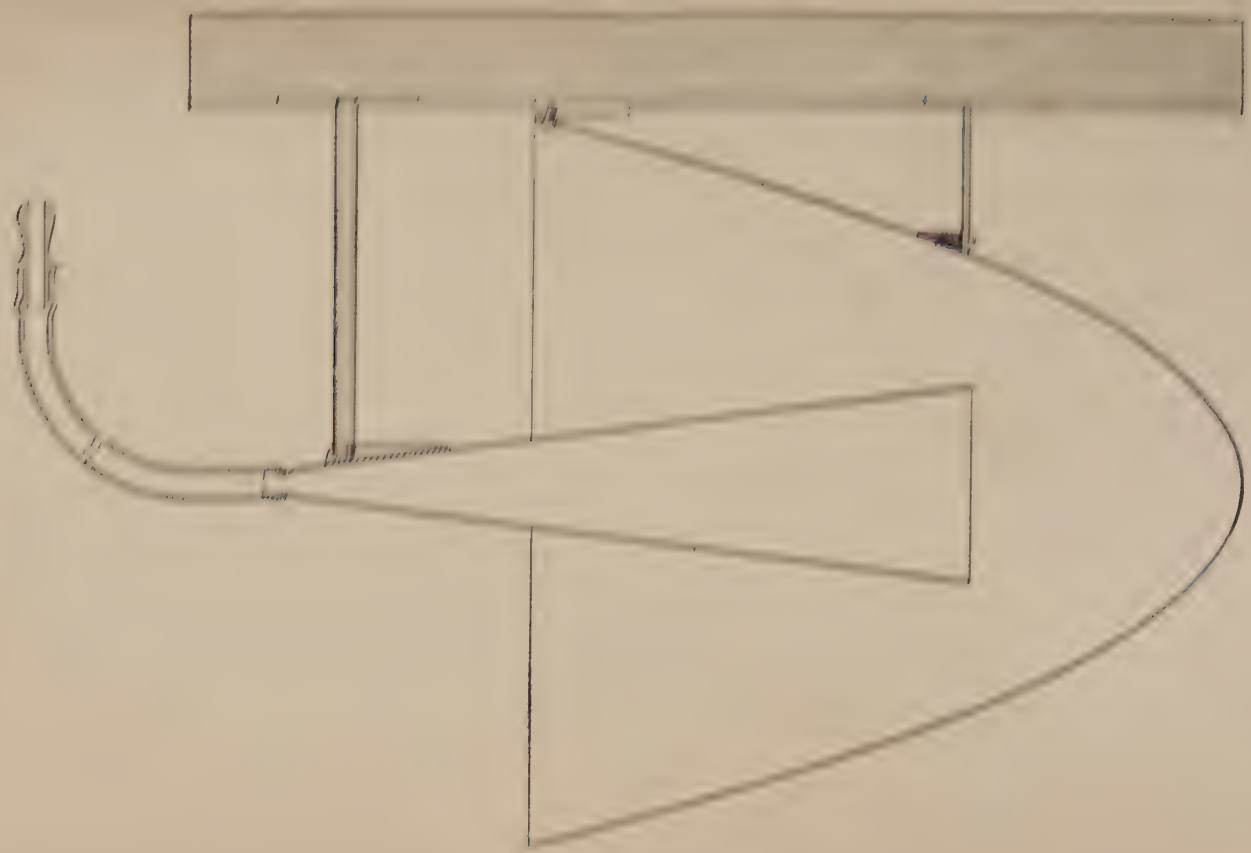
The importance of this is not appreciated by aurists as it should be, partly, perhaps, from the fear that the impression might be given that when artificial aids are advised the prognosis is no longer favorable and the case likely to be considered incurable. This fear, together with the general antipathy to the use of instruments, continues to prevent encouragement in their use, and may effectively hinder the scientific study of very interesting acoustic phenomena for the development of this department of otological research. To paraphrase the words of an eminent writer, "If it were not that the science of acoustics is one of the least perfect branches of human knowledge, and its practical application certainly the least understood, it would be easy to explain the principles on which perfect ear trumpets should be made."

Acousticians and aurists have, up to the present time, failed to furnish any single instrument to suit all cases, or indeed any satisfactory apparatus or mechanical means (besides the so-called artificial membranes) for restoring the function of hearing. It is true that a limited number of deaf patients find that some particular device serves to improve their hearing for certain sounds and individual voices, but there is no instrument which can be varied in shape so as to change with the varying character of the sounds desired to be heard.



SCHEME OF FOCUSING EAR TRUMPET.

FOCUSING EAR TRUMPET.



A few principles for guidance in the choice of proper instruments will be here ven. The size, shape, and length of each tube, as well as the condition of its terior surfaces, its mouthpiece, and ear tip, are to be first examined and com-red with those of all kinds obtainable. The size of the internal bore of a tube of prime importance, as every aurist knows by experience with his "otoscope," ich is usually made of flexible rubber tubing fitted at each end with ear tips. comparison of tubes of different caliber, though fitted with the same ear tips d of equal length, will quickly show that tubes are resonators for the various nes, and that the same sounds heard through the different tubes appear much ied in character. Cone-shaped tubes without breaks or seams within are best rmed to convey the sound waves to the ear.

the score of forms of ear trumpets offered for the use of the deaf by surgical-rument dealers, but three or four appear to be constructed with a view to ure the best results with the least expenditure of material. In order to meet mand for small instruments makers have been led to sacrifice utility for size, d on this account have fallen into error.

The ear trumpets which give the most satisfaction are those made on proper ustical principles without reference to size. These combine the reflecting par-ds with the cone-shaped conducting tubes. All the ordinary ear trumpets sist of large horns with wide extremities, tapering with more or less varied ves or with frustra of cones to the small ends, which are fitted with ear tips tended to fit into the auditory canal.

A cone-shaped tube tapering to a point, and with one of its sides partially cut ay, is the best kind of instrument for the use of those partially deaf. The cut the side, as now made, is of service in forming shorter columns of air in the , which serve as resonators for tones of high pitch (particals of tones), thus ing a more serviceable instrument than one formed from a plain cone.

Research and experiment in applied acoustics will accomplish what I hope to the way to by the presentation of instruments which in a measure fulfill indi-ous, and the aurists, to whom this work belongs, must undoubtedly profit by results.

illustrate my improved manner of condensing sound waves I shall present to section two forms of instrument. Strictly speaking the word "focusing" can plied as descriptive of the manner in which the sound waves are condensed referring to what takes place in one only of these forms, though the result ived at is practically the same in both. In the long axis of a metal reflector, ose sides are parabolic, a short, hollow, metal cone is placed with its large end ected inward. These are relatively so fitted that the cone can be adjusted for various focal points of the parabolic reflector by being moved nearer to or her from the apex of the reflector. To a cone-shaped tube tapering to a point of a length to correspond with the wave lengths of tones whose pitch is below fitted a small tube within which another tube is made to slide. To this latter a small hollow cone is fastened at one end; a short, curved tube is fitted at ther end. This comprises the portable form. By varying the length of the olumns within the cone and adjusting at different points a considerable varia-n in perception of tones is produced.

AN IMPROVED MIDDLE-EAR POWDER BLOWER.

By R. D. BARRET, B. S., M. D., of St. Louis, Mo.,

Clinical Assistant to the Department of Diseases of the Ear of the Missouri Medical College.

The little instrument I wish to describe to you as briefly, yet as clearly as ible, was designed primarily for the purpose of applying directly to the sed parts any of the various antiseptic powders so often indicated in the ment of those cases of chronic suppurative inflammation of the attic space. ation to the inflammatory process going on in the atrium. But it has proved for me the most convenient and perfect universal powder blower I have found

as yet, and I hope it may be equally as useful to others in every respect. Its three component parts are the canula, the receptacle for the powder, and the rubber hand bulb. The canula is similar to that of the Blake middle-ear syringe, 3 inches long, one-sixteenth of an inch in diameter, and has an upward curved extremity to direct the powder into the attic. A second canula with a straight point will add greatly to the range of usefulness of the instrument. The receptacle for the powder is a metal bulb an inch in diameter. From it projects a tube about three-fourths of an inch in length, and to the end of this the canula is attached.

At a point directly opposite is a short nipple, over which fits the rubber tube leading to the air bag. Over the opening of this nipple within the powder receptacle is soldered a wire screen with a mesh so fine that the finest powder will not pass through it unless rubbed, but still it does not interfere materially with the force of the air current. This screen prevents the powder from falling or being drawn into the rubber bulb. The powder receptacle is opened for filling by unscrewing a small segment of it, the center of which is the point of attachment of the canula. The base of this tube is encircled by a milled-edged band to prevent the annoying slipping of the fingers so frequently experienced with such instruments. To the under side of the largest part of this receptacle is fastened a handle in the shape of a loop through which the thumb is slipped in using the blower. The air bulb is the ordinary rubber bulb used for the same purpose on other instruments. The tube leading to it should not be over 3 inches long, and for one with a small hand even that is too long. In using the instrument the thumb is slipped into the handle from behind, the powder receptacle resting on the top of the thumb between the nail and the knuckle, the first finger steadying it by pressing the handle against the ball of the thumb, the rubber tube passing to the outer side of the thumb—not between it and the first finger—and the air bulb then falls naturally into the palm of the hand, when a very slight pressure upon it by the two or three free fingers puffs out the powder. A too forcible compression of the bulb simply blows the powder around the receptacle, but the least bit of force will puff it out readily. The canula is bent at an angle of 130 from the body of the instrument, hence it is all that is in the line of vision.

The right hand manages the instrument perfectly, leaving the left free to hold the speculum or for any other manipulation that may be necessary. The cannula and powder receptacle are nickel-plated, can be easily and quickly separated, cleaned, etc., and there is nothing about the instrument to break or get out of order every few days.

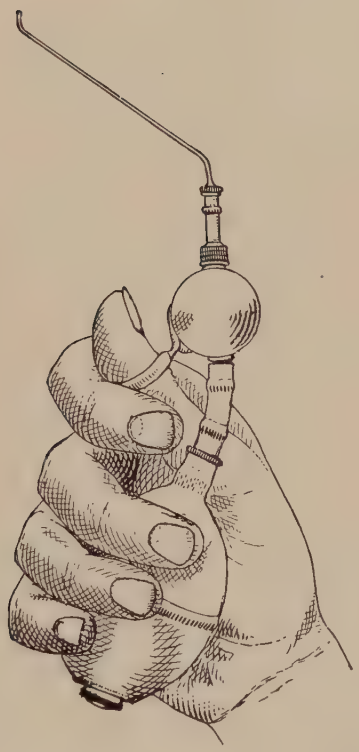
My sincere thanks are due to the Mellier Surgical Instrument Company of this city for the careful and skillful manner in which they carried out my idea and the perfect instrument they produced.

ADENOIDS A CONTRIBUTIVE FACTOR IN AURAL AFFECTIONS.

By M. D. LEDERMAN, M. D.,

Assistant Surgeon, Manhattan Eye and Ear Hospital; Instructor in Laryngology and Rhinology, New York Polyclinic; Assistant Laryngologist and Otologist, Mount Sinai Hospital Dispensary.

Although hesitating before offering an abbreviated paper upon a subject which has generated such universal discussion, the continued appearance of neglected cases permits the expression of pleasant results observed after the removal of this frequent causation of middle-ear disease, especially in children. Realizing that this subject has already commanded the attention of some of my auditors, I console myself with the thought that this field of medicine has been so thoroughly



AN IMPROVED MIDDLE EAR POWDER BLOWER.

cultivated it would seem impossible to make an absolute discovery. However, I trust you will bear with me, in the hope that there may be a few among those present who have not given this cause its deserved recognition.

When we consider the percentage of ear diseases prevalent in early life it, behooves us to carefully investigate the observation of clinical experience and test the virtues of its information. It is indeed gratifying to reëcho the statements of others interested in this topic, and to conscientiously testify to the delightful benefits derived from the ablation of the hypertrophied lymphoid tissue in the post-nasal space, especially in cases of suppurative otitis chronica. Although appreciating the impression produced in offering statistics upon any given subject, I will not tire you with them, but with your kind indulgence will give later the history of two or three cases that demonstrate these few remarks.

In attempting to ascertain the immediate influence which the hypertrophied pharyngeal tonsil has upon ear disease we are confronted with numerous proposed theories.

Before giving any of these in detail, I briefly quote the statements of some authorities on the disturbing effects of so-called "adenoids" upon the sense of audition. Woakes * expresses his experience in these words:

Interference with the organs of hearing, inducing more or less deafness, is the most frequent and to my mind the most important of the direct lesions resulting from the disease. Not more than 5 per cent of my cases have escaped this complication.

Beverly Robinson † mentions the observations of Dr. Swinburne, who states that "in a large proportion, indeed in all cases, of adenoid vegetations the ears were found diseased." Again, Dr. Robinson adds that "other observers have described the great frequency of aural complications in cases of adenoid vegetations." Under the symptomalogy of hypertrophy of the pharyngeal tonsil, Dr. Bosworth's ‡ experience is so clearly expressed, I can not offer a more weighty thought than to quote verbatim from his valuable work:

Probably no symptom of the disease possesses greater importance or requires more thorough appreciation and study than that of ear complications, occurring, as they do, early in life and at a time when their prompt recognition only may save the patient from permanent loss of this important faculty.

In referring to cases of total deafness in children due to this lymphoid swelling, Lavrand, § of Lille, considered the growth to be a cause of deaf-mutism, and thought that their removal would act as a possible cure of the latter affection. If we believe that this pitiable condition is contingent upon pharyngeal vegetations, their predominating influence is truly amazing. In a very interesting and instructive brochure ‖ upon Lymphoid Growths in the Vault of the Pharynx, Dr. T. R. French informs us that deafness as a complication of this disease occurs in more than half the cases. With such statements before us we can not lay too much stress upon the immediate relationship the nose and naso-pharynx bear to aural disturbances.

My experience in clinical and private practice certainly proves the immediate influence this disease has upon the production of deafness, be it a catarrhal or suppurative manifestation. I have watched the progress of young patients under the routine treatment of syringing, peroxide of hydrogen drops, with boric-acid insufflations, and though the suppuration ceases for the time the patients would often return with another outbreak. These recurring attacks were promptly overcome by ridding the pharynx of its irritating occupant. We should never consider an

* Woakes, Post-Nasal Catarrh.

† Beverly Robinson, Treatise on Nasal Catarrh and Allied Diseases.

‡ Bosworth, Diseases of the Nose and Throat, Vol. 1.

§ Lavrand, Annual of the Universal Medical Sciences, Vol. 4, 1890.

‖ Paper read before the Kings County Medical Society, August 18, 1893.

examination of a patient with ear difficulty completed until the nose and naso-pharynx have been thoroughly inspected. In children we should never hesitate to bring to our aid the proverbial eye at the end of the finger. It is not exaggerating to assert that the majority of running ears in children, together with the depressed condition of their general health, is the consequence of this often-neglected factor. It is not unusual to diagnose the presence of these growths by the child's facial expression alone. The senile appearance of the young one, the drooping eyelids, together with the open mouth, are indicative of the post-nasal obstruction.

As to the theories suggested in the causation of ear disease by these growths, Bosworth supposes the trouble to be due to an interference with the renewal of air in the middle chamber. Any cause which interferes with free nasal respiration, if continued sufficiently long, is liable to produce impaired hearing by creating a stagnation and rarefication of air in the pharyngeal vault. The free action of the levator palati muscles is hindered by the hypertrophied tissue, thus preventing their compensating action. A catarrhal process is incited by this rarefication, an hyperæmia and its consequences appearing in prompt succession. Lowenberg concludes that the inflammation is a direct continuation of the pharyngeal involvement. Blake reasons the result to be due to a passive hyperæmia of the middle ear, by interference with the return circulation, owing to the pressure exerted by the post-nasal growths upon the pharyngeal veins. This seems quite a plausible theory, and we can readily imagine that some such effect may be the result if the blood current of the neighboring tissues is materially obstructed.

My views incline toward the supposition of some disturbance of the circulatory function. There can be no doubt that the presence of this foreign element influences the blood supply, thus exciting a congestion of the local tissues, and possibly affecting the vasomotor system of the middle ear as well, thereby giving rise to an inflammatory process. We are yet in the shadow of a revelation which I earnestly hope will soon illuminate the present obscurity.

In dwelling upon the immediate relation of this factor in the production of aural complication, it would be unpardonable had I omitted mentioning the deleterious influence that nasal stenosis has upon the organ of hearing. Suffice it to state that in the majority if not in all cases of otitis media catarrhalis chronica in which there exist some obstructing lesion in the nose, we may sincerely expect to improve the patient's hearing by removing the barrier to normal respiration, thus allowing the necessary aeration of the Eustachian tube and middle ear. The proportion of children under 10 years of age that are subject to adenoid growths is so large that I anticipate their presence in almost all cases of middle-ear suppuration, particularly if it be of a chronic nature. The happy results obtained from the thorough removal of the pharyngeal obstruction in such cases permits me to cheerfully promise a speedy relief from the offensive discharge and an improvement in the hearing distance, not overlooking the beneficial effects upon the general health of the patient.

Very briefly I mention the history of a few cases, in one of which the discharge ceased surprisingly soon after the surgical treatment:

Case 1.—Nettie G., 3 years of age, well nourished; mother noticed that the child experienced difficulty in breathing; was restless at night; tossing about in sleep, snoring loudly; lips were parched and covered with a deposit of dried secretion in the morning; in short, a mouth-breather. The little one had attacks of fever off and on, in one of which an acute suppurative otitis media developed. There was some pain before pus showed itself, but it was not distressing. The ear was treated by the family physician with hot-water douches and boric-acid insufflations. The suppuration ceased for two months, then reäppeared with acute symptoms. The same treatment was continued, with a cessation of the discharge. With the next appearance of the difficulty the patient came under my care. The history being so pronounced, and the expression of the child's face being quite typical, I immediately examined for adenoids, and found the pharyngeal vault

ompletely filled. The growths were removed under an anæsthetic by means of he curette. On the fourth day following the operation no sign of suppuration vas visible. Peroxide of hydrogen failed to reveal any pus. Until the present ime (almost a year since the operation) the child has had no reäppearance of ner trouble. Her hearing has improved considerably, as shown by the voice test. At time of operation watch and finger-nail tests were not satisfactory. The child vhen last seen affirmed to the watch test at 3 feet and heard the voice in the usual one. The parents noticed the improvement in hearing three weeks after the operative treatment.

Case 2.—The pleasant effect of the surgical treatment in this particular case nakes the history unusually interesting. I am indebted to Dr. Alvarez for the following history: J. H., aged 7 years. Mother lived in Florida, and while preg-nant with this child had an attack of chills and fever. The child was born in New York. Three months after his appearance into the world the infant was also attacked with chills and fever. This lasted for a week or ten days, and was treated by the family physician as malaria. Ever since the boy has had period-cal fevers every two or three months. Dr. Alvarez first saw the patient in the spring of 1891. Doubting these attacks to be malarial, yet unable to ascertain heir origin, he recommended a change of climate. The child spent the summer n the Catskill Mountains, but no improvement was noticed. The temperature in hese febrile attacks never arose above 101°. In August, 1892, the young lad became more ill than usual, and Dr. A. discovered that the faucial tonsils were narkedly hypertrophied and adenoid growths were present in abundance. He hen associated the periodical fevers with his discovery. In November following he little fellow became the victim of an acute otitis media suppurativa of both ears, which failed to get well under the usual treatment. This ear continued dis-charging until February, 1893, when I was requested to see the patient. The removal of both tonsils and adenoids was at once performed. The running ears ceased to flow at the end of two weeks, and up to the present time the periodical fevers have not returned.

Through the kindness of Dr. Gruening, I briefly offer the history of an interest-ng case which proves the direct effect this common affection has upon aural dis-ease. A boy 5 years of age had two attacks of double-sided suppuration, compli-cated with mastoid disease, and at each attack the doctor was obliged to operate upon both mastoids. After the removal of the adenoid vegetations the patient rapidly recovered, and has had no attack since that time. Dr. Gruening expresses his experience in the following words:

> I have repeatedly observed cases of otitis media purulenta which, though yield-ng temporarily to local treatment, had a tendency to recur, and that the tendency ceased when the adenoids had been removed. These and other cases lead me to believe that adenoid vegetations are a causative factor in purulent disease of the middle ear and the mastoid.

Such observation is conclusive evidence of the important relation that this exciting factor bears to middle-ear disease. True, we sometimes find suppurative cases in children in which the adenoids are wanting, but they are indeed very few. It is not in the realm of this brief paper to dwell upon the methods employed in the removal of these growths, but will state that I have found the modified Gottstein's heart-shaped curette, together with the use of Lowenberg's post-nasal forceps, improved by Dr. Gleitsman, of most service. The continued employment of a favorite instrument leads one to become too greatly impressed with its superiority, and we are apt to overlook the good qualities of others. It is therefore necessary to test the merits of the modern modifications and by personal experience select the most serviceable. Dame Nature has considerately supplied some of my esteemed colleagues with strong finger nails, which have been cultivated and used with success in the destruction of the hypertrophied tissue. I doubt, however, whether this natural instrument is as successful as the manufactured curette or forceps, especially if the growths have assumed a fibroid character.

The method employed is immaterial so long as the tonsil is completely extir-pated. A small portion of lymphoid tissue remaining may give rise to further difficulties. If we follow the custom of regularly examining the adjacent parts

of patients complaining of aural symptoms, we would frequently discover the origin of their discomfort.

In closing I can not offer a more appropriate thought than the one expressed in the words of Hamlet:

> That we find out the cause of this effect;
> Or rather say, the cause of this defect,
> For this effect defective comes by cause.

DISCUSSION.

Dr. T. V. FITZPATRICK, Cincinnati, Ohio. I most heartily concur in the doctrine set forth in this paper of the necessity of surgical interference in cases of adenoid vegetations or hypertrophy of Luschka's tonsil. Since the paper of Meyer, of Copenhagen, of twenty years ago, but little new has been said in favor of the necessity of surgical treatment of this hypertrophy. The evidence is only accumulative. What we need most is investigation of the cause or causes of this hypertrophy. My own observations are leading me year after year gradually to the conclusion that a state of suppuration, nasal or pharyngeal, is an essential precedent to the hypertrophy. I think we find a very apt analogy in the hypertrophied lymphatic glands in their attempt to carry off suppurative processes. Most of these cases will improve under antiseptic treatment, though I doubt if the true hypertrophy of Luschka's tonsil is ever cured by any antiseptic treatment, certainly not under many years. Suppurative rhinitis and pharyngitis in children is very common. Its far-reaching influence is probably due to the absorption of ptomaines. Recent investigations have shown in ozena that when a suppurative process is stopped the anæmia so often associated with it is arrested. We often find cases of adenoid vegetations of the vault of the pharynx anæmic. This can scarcely be due alone to the obstruction offered respiration by the hypertrophy, but is probably due to suppurative process associated with the disease. The theory of Hill, that this enlargement is due to the arrest of the migration of leucocytes, merits investigation. So far but little light has been thrown upon the cause, consequently nothing is done in the way of prevention.

To refer again to the disastrous influence which these lymphoid growths may and do exercise upon the organ of hearing, I can not too strongly advocate the course recommended by the essayist. He is right when he says that in purulent processes of the middle ear the routine treatment is entirely too often carried out, when an examination of the post-nasal space would readily reveal the cause of the recurrent attacks of suppurative inflammations. We must not always expect to find all the typical symptoms of adenoids presented in such children, but we must look for their presence in all cases where recurrent attacks of suppuration take place in young persons. I wish to also emphasize the fact that it has been my experience to find otherwise intractable cases of acute as well as chronic middle-ear catarrh frequently associated with adenoid hypertrophies; and we would probably oftener see speedy and more permanent improvement in such cases if we would establish the rule to always examine the post-nasal space.

CRANIOMETRIC MEASUREMENT OF 500 SKULLS IN RELATION TO AURAL TOPOGRAPHICAL ANATOMY.

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Aural anatomy and topography have of late years been the subjects of a number of interesting and valuable studies, stimulated by the increased specialization of otological work and the greater employment of bolder surgical procedures. The

question of the topography of the temporal bone has grown steadily more pressing, for the success attained by surgery in many directions is widening the operative field and urging the surgeon to intervene radically upon less vital indications than were formerly regarded as his sole justification. Especially is this the case in relation to mastoid trephining, which was reïntroduced after a century of discredit, as a life-saving operation in cases of empyæma or caries of the mastoid. Now it is coming into use in the group of cases where intractability alone marks the case as dangerous, since the danger to life of skillful operation has come to be smaller than that of timid temporizing. Everything that tends to further lessen this peril constitutes a real step in the advance of otology in this and other directions, and gives promise of making it one of the most successful fields of medical practice, instead of being one that is now often, however unjustly, adversely criticised. Notable among these anatomical studies are those of Bezold, Hartmann, Zuckerkandl, Ruedinger, and Leidy, and from each of these we can claim important teachings, the two first having dealt specially with the operative aspect of the mastoid process. Bezold was the first to note a relation of aural topography to the form of the skull, and he pointed out that the lateral sinus was apt to be more forward and superficial, more vulnerable in ordinary mastoid trephining, in the short, broad head. He also laid stress upon the larger size of one lateral sinus, usually the right, because the longitudinal sinus usually passes almost directly into it, while the other receives only the smaller venous trunks. Without giving the statistics for its verification, he estimated that the right sinus is the larger in 70 per cent of instances, although in his 48 pairs of temporal bones there cited the left was larger 9 times and the right but 13. Schültzke gives 40 per cent as his finding in this respect, and among my 50 pairs the right sulcus is larger in 56 per cent. With this larger size there is often a more curved course of the sinus, which hollows a deeper channel forward and outward; and Zuckerkandl called attention to the occurrence of bulbous enlargements upon the vessel, which at times greatly increase its dangerous relations.

O. Koerner, of Frankfort, in an article in The Archives of Otology in 1887 (Vol. XVI, p. 281), expanded this view as to the influence of skull form upon the topography of the temporal bone, finding in his measurement of 60 skulls of various types and races that the brachycephalic crania, those short for their breadth, were distinctly the more dangerous. Hence, the mere measurement of the length and breadth of a patient's head would give strong presumptive evidence of the location of the lateral sinus and the middle cerebral fossa and have important bearing upon the question of the indications and prognosis of operation. So simple a solution of a difficult problem challenged attention and called for the further investigation of the matter, which Koerner invited. Many accepted the clear and plausible showing of his study as conclusive, while others, confirming his results in their earlier measurements, as I did, made clinical application of his rule with apparent satisfaction. Politzer, in his text-book, referred to the rule as likely to be valuable if confirmed by adequate statistics, but regarded 60 measurements as wholly insufficient. Schültzke, in the Archiv fuer Ohrenheilkunde, Vol. XXIX, p. 201, set forth a contrary series of results as his finding in a similar series of 60 skulls, pointed out some fallacies in Koerner's work, and left the problem as complicated as before. Koerner gave his measurements of 27 more crania as confirming his former results, and has since sectioned and remeasured some of the temporal bones previously measured to confirm his results. My studies were begun in 1888; but as I desired a wide basis before attempting any generalization, only a preliminary statement of my methods has been thus far published, and I much regret that I can now bring forward the figures of but one-half of the intended thousand.

Craniometry has by no means a settled and fully accepted method of determining even the fundamental points of skull dimension, and some of the discrepancies

between various workers lie in the matter of the primary conception of "skull index." Following some of the older craniologists, Koerner adopted the parietal protuberances as the points at which the skull breadth is to be measured, thereby obtaining figures generally smaller than the maximum breadth of the cranium and having no definite relation to it. Schültzke has followed the more authoritative method of obtaining the very greatest interparietal width, just as he takes the maximum length, from the glabella rather than the nasion to the occiput at its most prominent point, whether this be the inion or not. A greater breadth can at times be found between points on the squamæ of the temporals, but this may be from the springing of these bones out of place in the process of maceration. This is the method which I have followed, waiving any theoretical advantage which might be gained by measuring in fixed planes precisely at right angles to each other to obtain the length, breadth, and height. The index given is this maximum length divided by the maximum breadth, not the less convenient figures used by Koerner, who divided the breadth into the length. In the classification of the specimens, instead of assuming a geometrical line at the index 1.30, as does Koerner, as separating the long from the short crania, I have followed the best authorities in considering all skulls with indexes from 0.777 to 0.799, inclusive, as mesocephalic and constituting an intermediary type. This makes no little difference in the rating of crania. Thus one of the rare skulls having the transverse breadth at the parietal protuberances equal to the maximum, 134 mm., and a length of 172 mm., would be brachycephalic (with index 1.28) according to Koerner, while rightly rated as mesocephalic (index 0.779) in my tables. Another, 154:192, would hardly be brachycephalic (index 0.802), although markedly so (index 1.19) in Koerner's notation.

Yet further, in the more common instances where the width at the protuberances falls below the true breadth, the rating differs still more widely; and a skull 150:183, instead of receiving its true brachycephalic index of 0.814, would be held by Koerner to be dolichocephalic with index 1.32, because the distance between the tuberosities was only 138 mm. Besides these distinct differences in viewing the figures obtained, Koerner used a method of orthographic projection, rather than direct mensuration, to obtain the height of the floor of the middle cerebral fossa—a method possibly more exact for measuring the minimum distance, but only so after the point of greatest vulnerability has been otherwise determined. It must be admitted that the mensuration by calipers is almost sure to exaggerate the distances under the circumstances here met, since it is difficult or impossible to avoid slight obliquity in the position of their points. Yet this was fairly constant throughout the similar measurements of the investigation and usually too minute to be worthy of more than this passing mention. Accuracy to a fraction of a millimetre has not been attempted here; yet comparison with previous very careful measurements of the same crania has shown few and minute discrepancies, and only a very narrow margin of error can be conceded.

In deciding as to the dangerous relations of the sulcus of the lateral sinus, Koerner lays stress almost solely upon the superficial position, holding its forward position to be closely commensurate with its proximity to the mastoid convexity. No statistics are given in support of this view which had been set forth by Bezold and Hartmann; and he does not, like the latter, state the position of this thinnest point back of the meatus. Hence he leaves us wholly uninformed whether the temporal bones with the most superficially placed sigmoid sulcus, may not have been absolutely safe, since this portion of the sinus lay far posterior to the field of mastoid operation.

The orthographic method can be employed only on skulls sagittally or otherwise sectioned, a limitation which Koerner has himself felt; whereas far larger series of cranial measurements must be secured before any claim to rules of general

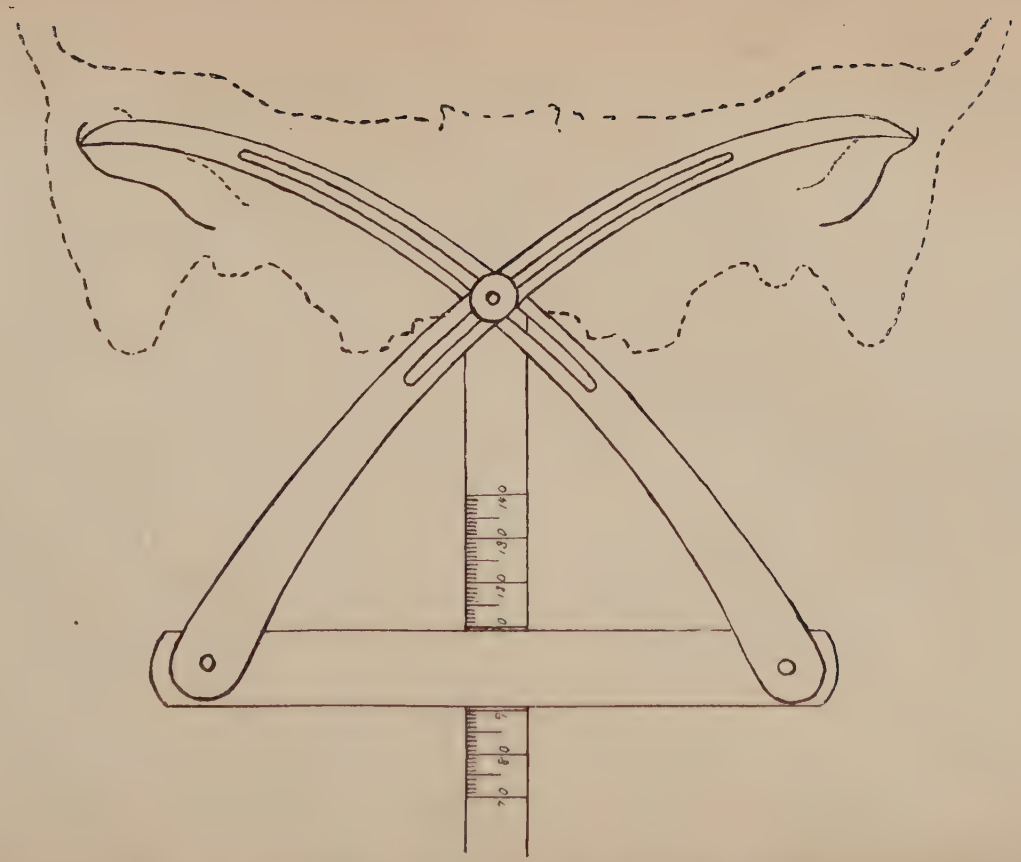
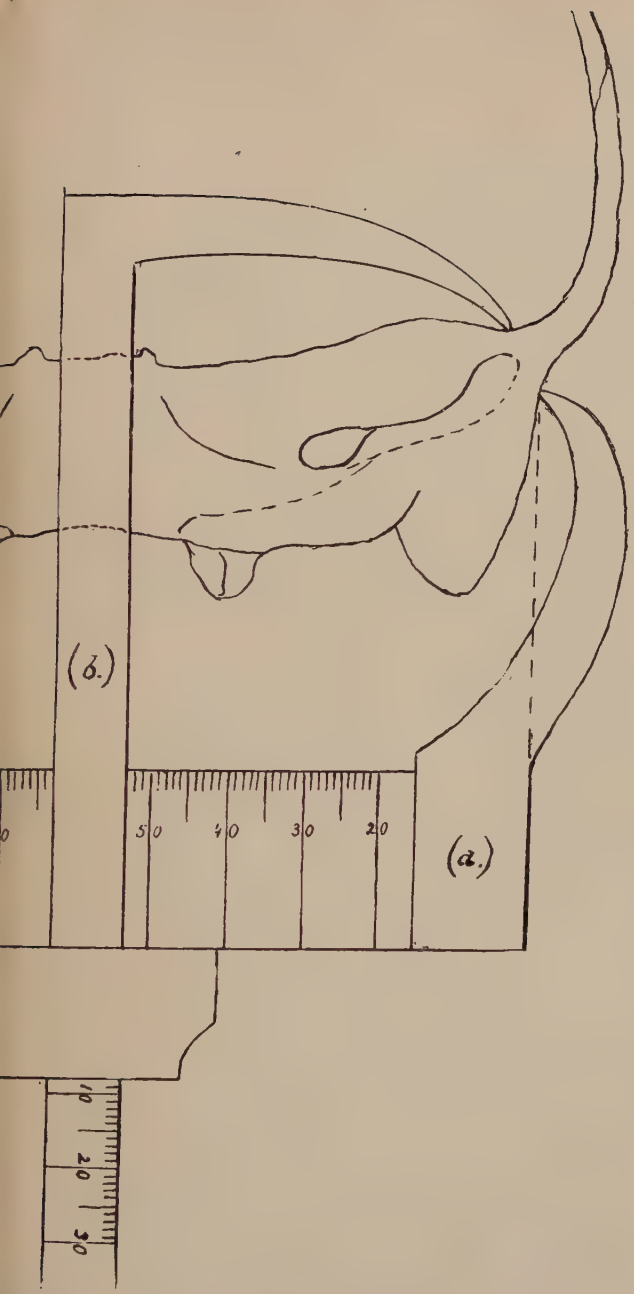


Fig. 1.—INSTRUMENT TO MEASURE WIDTH BETWEEN SIGMOID SINUSES.

Fig. 2.—DETERMINATION OF THE MO



BLE POINT OF THE MIDDLE CEREBRAL FOSSA.

applicability can be ventured. A method has, therefore, been devised which can be used with any intact skull, is ready of employment, and yet gives results which are sufficiently accurate for all surgical purposes, for when it becomes a question of a fraction of a millimeter operative skill, rather than anatomical knowledge, must be relied upon to prevent disaster.

My procedure in measuring was as follows: With an ordinary pair of calipers the cranial length was taken from the most prominent part of the glabella between the superciliary ridges to the most distant point of the occiput, often above the protuberance. This length was then read off by applying the points to an accurate millimeter scale. The extreme breadth was similarly taken between the parietals, with the calipers held exactly transverse and their points on the same level. The distance between the parietal protuberances was also taken as by Koerner. In like manner was taken the width between the spinæ supra meatum and the intermastoid distance at an "operation point" 5 mm. behind the spina with the ordinary calipers, or the sliding calipers described later. For the maximum width between the sigmoid sinuses a special instrument was employed through the foramen magnum, a pair of inside calipers as figured in the cut. (Fig. I.) A plain pair of calipers then served to measure the thickness of bone between the sulcus and the operation point, 5 mm. back of the spina, between the sulcus and the back wall of the auditory meatus, and at the thinnest point of the mastoid, where the sinus most nearly approached the surface of the process. The distance of this thin point posterior to the spina was also noted. To determine the position of the most vulnerable part of the middle cerebral fossa, a sliding caliper (Fig. II), like a shoemaker's measure, was used to take the position and plane of the spinæ, and a detached L scale, as figured (*b*), was passed through the foramen magnum and applied to the lowest and most external part of the fossa, as determined by sight aided by touch. Its external portion was then brought into relation with the outside calipers, its rectilinear position secured by application of its mortised block to the lower edge, its relation to the plane of the spinæ secured by apposition of the surfaces (or any deviation from that plane made evident), and then the position of the point read off as to its height and lateral distance within or beyond the spina. The figure makes clear the manœuvre, which was really simpler than the description may suggest. The relative size of the lateral sulcus of each side was then determined by the eye and similarly that of the jugular caput and foramen. All the more difficult measurements were made in strong light, generally full sunshine; and the translucency of the bone permitted much more to be seen through the foramen magnum than might be expected, while it made easy the location of the most superficial portion of the sulcus, and in the dangerous bones made the condition readily manifest.

The crania measured consisted of the Hyrtl and other collections in the Mütter Museum of the College of Physicians of Philadelphia, the skulls in the Wistar and Horner Museum of the University of Pennsylvania, about 100 specimens in the Army Medical Museum in Washington, and lastly a number in the Academy of Natural Sciences in Philadelphia. To the curators of these museums and to others who have kindly aided me in my researches, I desire here to tender my grateful acknowledgment. The specimens utilized were unselected in so far that I have presented here the figures of every measurement completed. Adult Caucasian crania were preferred when they were at hand; deformed specimens were excluded, and a number of partially measured crania have been omitted from this report because of the incompleteness of the data. At the last, as the 500 was nearly complete, extreme specimens were sought in the rich collection of the Academy of Natural Sciences, in order to fill out symmetrically the groups into which I divided the various types. But no single specimen was introduced or omitted because of any selecting of specimens to point for or against any hypothesis.

In the detailed tables the figures are given for each cranium, and the width at the parietal tuberosities is given for the use of anyone who regards that as the proper position for determining the transverse diameter. Any other employment which can be made of the studies and any other conclusions which can be elicited from them will, I hope, be freely made. In the other tables I have summarized the findings which appear to me to be their most important teachings.

TABLE I.

	210 dolichocephalic skulls (0.61 to 0.776).			80 mesocephalic skulls (0.777 to 0.799).			210 brachycephalic skulls (0.800 to 0.97).		
OPERATION ROOM.									
Right:									
Maximum	20			19			18		
Average	10.8	[1]65		11.79	[1]29		11.7	[1]65	
Minimum	0.3			6			1		
Left:									
Maximum	25	[2]52		17	[2]22		20	[2]60	
Average	11	[1]92		11.84	[1]29		12	[1]85	
Minimum	0			5			0.2		
MEATUS TO SULCUS.									
Right:									
Maximum	21			18			18		
Average	11.4	[1]59		12.5	[1]24		12.3	[1]70	
Minimum	1			6			0.3		
Left:									
Maximum	25	[2]57		20	[2]22		20	[2]67	
Average	12.5	[1]94		12.8	[1]34		12.4	[1]73	
Minimum	0.2			6			0.4		
THINNEST POINT.			*Back of spina.*			*Back of spina.*			*Back of spina.*
Right:									
Maximum	15		30	15		30	15	[1]62	30
Average	6.19	[1]66	17	6.17	[1]22	18.3	5.9		18.3
Minimum	0		5	1		4	1		5
Left:									
Maximum	17	[2]51	30	18	[2]16	29	18	[2]51	30
Average	6.51	[1]93	16.9	6.89	[1]42	16.6	6.6	[1]97	17.5
Minimum	0.5		5	2		5	0.2		1
FOSSA HEIGHT.									
Right:									
Maximum	14	[1]124		18			15		
Average	6.7			6.27	[1]41		6.6	[1]119	
Minimum	0			0			0		
Left:									
Maximum	14	[2]48		12	[2]21		15	[2]42	
Average	5.4	[1]38		5.94	[1]18		5.7	[1]49	
Minimum	0			1			0		
	Sulcus larger: R. 93; R. ♀ 15; equal 15; L. ♀ 24; L. 63. Jugular fossa larger: R. 110; R. ♀ 15; equal 13; L. ♀ 6; L. 66.			R. 40; R. ♀ 12; equal 6; L. ♀ 5; L. 17. R. 52; R. ♀ 2; equal 7; L. ♀ 2; L. 17.			R. 92; R. ♀ 26; equal 26; L. ♀ 18; L. 48. R. 115; R. ♀ 12 equal 31; L. ♀ 10; L. 42.		

[1] Larger. [2] Equal.

TABLE II.

	60 extreme dolichocephalic skulls (0.61 to 0.729).			Average for 500 skulls (0.61 to 0.97).			60 extreme brachycephalic skulls (0.86 to 0.97).		
OPERATION ROOM.									
Right:									
Maximum	20			20			17		
Average	10.4	[1]18		11.3	[1]159		12.1	[1]16	
Minimum	0.3			0.3			6		
Left:									
Maximum	25	[2]15		25	[2]135		18	[2]20	
Average	11.2	[1]27		11.8	[1]206		12.6	[1]24	
Minimum	0			0			0.2		
MEATUS TO SULCUS.									
Right:									
Maximum	20			21			18		
Average	11.2	[1]14		12.1	[1]153		12.7	[1]22	
Minimum	0			0			7		
Left:									
Maximum	25	[2]14		25	[2]146		18	[2]20	
Average	12.4	[1]32		12.5	[1]201		12.5	[1]18	
Minimum	0.2			0.2			3		
THINNEST POINT.									
Right:			*Back of spina.*			*Back of spina.*			*Back of spina.*
Maximum	15		40	20		40	15		30
Average	6.4	[1]17	15.6	6.1	[1]151	17.8	6.8	[1]18	18.4
Minimum	0.3		0.5	0		0.5	3		11
Left:									
Maximum	16	[2]15	35	18	[2]118	35	18	[2]17	24
Average	6.8	[1]28	15.5	6.6	[1]231	17	7.4	[1]25	17.7
Minimum	0		2	0		1	0.2		5
FOSSA HEIGHT.									
Right:									
Maximum	14			18			12		
Average	6.3	[1]30		6.6	[1]287		6.3	[1]28	
Minimum	0			0			0		
Left:									
Maximum	14	[2]11		15	[2]111		14	[2]12	
Average	5.7	[1]19		5.6	[1]102		5.9	[1]20	
Minimum	0			0			0		
	Sulcus larger: R. 29; R.? 2; equal 3; L.? 4; L. 22. Jugular fossa larger: R. 30; R.? 5; equal 5; L.? 1; L. 19.			R. 225; 45 per cent; R.? 53; equal 47; L.? 47; L. 128; 25.6 per cent. R. 277; R.? 29; equal 51; L.? 18; L. 125.			R. 23; R.? 6; equal 8; L.? 8; L. 15. R. 30; R.? 3; equal 13; L.? 4; L. 10.		

[1] Larger. [2] Equal.

Summarizing the results gained from these 500 skulls, we find that they furnish us with 80 crania of medium index (0.777 to 0.799) and 210 on each side of this mean, not a few of which are extreme examples of the long and short head, respectively. Tabulating the figures, it is at once manifest that while Koerner's claim is perhaps sustained, that the right sigmoid sulcus more closely approaches the mastoid surface than the left, and is more superficial in the brachycephalic skull; this difference averages but a fraction of a millimeter; and the thin point is a little nearer the field of operation in the dolichocephalic. More important in this connection is the occurrence of minimum results in crania of every type and on either side—the left sulcus being the larger or the more superficial in 25 to 30 per cent. Yet the value of Koerner's measurements, when confirmed, is greatly lessened when we note that the approach of the sinus to the surface is not accompanied by a commensurate forward position; for the distance of the sulcus from the back wall of the external auditory meatus averages some 6 mm. more than from the mastoid surface, and holds no constant relation to the other dimension. It is, perhaps, smaller in the dolichocephalic; although in both types rather smaller on the right side.

Still more practical seem the figures indicating the "operation room," that is, the space intervening between the lateral sinus and the chisel of the operator when he begins to trephine the bone at a point but 5 mm. back of the spina supra meatum. This appears to average nearly the same on the two sides, although more often less on the right; but it is a millimeter smaller in the long head than in the short head, and is sometimes only 1 mm. or less, so that careful inspection would probably detect the dark sinus close beneath the bared surface. Zuckorkandl has described a temporal bone in the Vienna collection which presented a large dehiscence of the mastoid convexity, where the sinus wall was exposed; and this study cites a specimen in the museum of the Philadelphia College of Physicians, a Tartar adult male, of 0.68 index, where there were 2 mm. of bone covering the sinus externally, but a large dehiscence into the upper back wall of the meatus. No craniometric finding, therefore, can in any way relieve the surgeon from the apprehension that, in the case before him, the lateral sinus may be so superficial and anterior as to preclude operation in the usual way. No plan of operation and no instrument will insure safety; and Hartmann's rule is fully justified, always to operate as though the position of the sinus were probably a very dangerous one. This becomes the more clear by study of the second table, where the general averages of all the 500 skulls are presented in contrast to those of the 60 crania at each end of the series, which constitute the extreme examples of the opposed skull forms. Here appears the curious contradiction to Koerner's hypothesis in that the extreme brachycephalic skulls presented on the right side no instance of minimum results, gave on the average more operation room than the dolichocephalic and presented a larger right sulcus and a dangerous relation less often than the general average and still less often than the opposite long type of head.

Turning now to the second point of danger to be avoided by the operator, the relation of the middle cerebral fossa to the operation field, we find another diametrically opposite result from Koerner, in that a precarious position was more common on the left side than on the right in every type of cranium, and in the dolichocephalic rather than the brachycephalic, thus confirming the finding of Schülzke. The extreme types of skull are seen to be closer to each other than to the general average in this regard, each showing nearly the maximum height at times, or again a fossa reaching exactly to the level of the upper margin of the external meatus. In no instance was the middle cerebral fossa found lower than this fairly convenient landmark, and in almost all instances the floor was higher in the operation field farther back; so that a trephining channel which did not go above this level would seem always sure to avoid all danger. This may be considered sufficiently accurate for all practical purposes. Where we come to fractions of a millimeter in dimensions, safety becomes a question of surgical skill, not of anatomical knowledge.

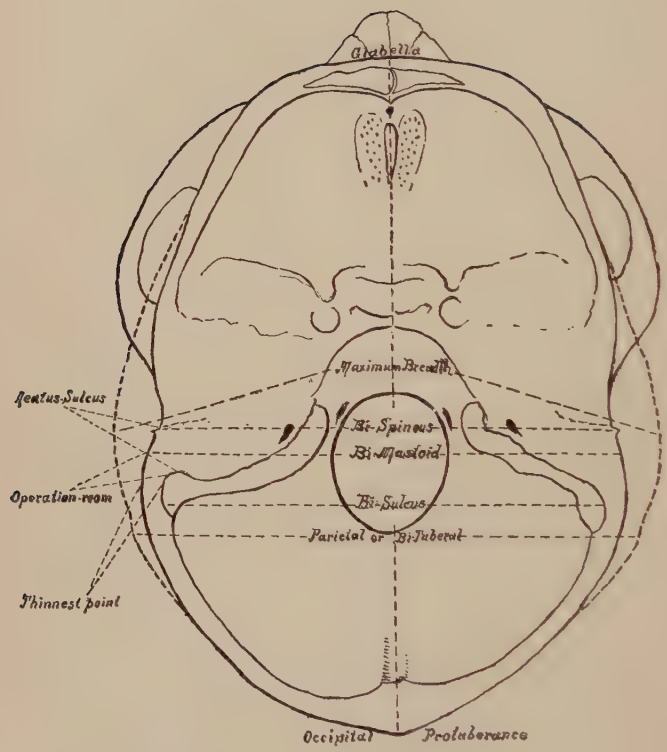
Some description of the instruments devised and their methods of employment should accompany the diagrams and make clearer the measurements taken. The inside calipers (Fig. 1) consist of a crossing pair of slightly curved arms 120 mm. long, pivoted 75 mm. apart, and centrally slotted through about half their length in order to articulate with a graduated rod sliding in a vertical mortise through the center of the base. Movement of this vertical rod forward or backward symmetrically separates or approximates the tips of the calipers, and their distance apart at any moment is accurately shown by the graduation upon the scale. The points can be brought close together for easy introduction through the foramen magnum, there expanded until they meet the sides of the sulcus on each side, their most external position found and verified by observation through the same opening, and then the distance read off to a fraction of a millimeter. The plane of this measurement is easily determined in relation to that of the spinæ, the outside calipers serving, at need, to demonstrate its exact distance back, and any lack of symmetry in the height or distance out or behind the spinæ.

The instrument for measuring the relations of the middle cerebral fossa consists of a sliding caliper scale (*a*), with curved points, of sufficient length to embrace the skull from below and close upon the "spina supra meatum" or the depressions just behind them, where they are readily held by light pressure. The second part of the instrument (*b*) consists of an L scale with an arm 50 mm. in length and a mortised block sliding upon it so as to furnish an edge at right angles to its length. Introduced through the foramen magnum, the tip of its curved arm easily finds the lowest and most external portion of the middle cerebral fossa or any other point more exposed to injury by proximity to the trephining track, the surface of its long arm is brought into apposition with the external scale, so as to show that the tip is in the plane of the spinæ, its sliding block is pressed against the lower edge of the external scale to secure its vertical position, and then the height of its tip above the spina can be read off from the graduation. At the same time, its outer edge, which is just 50 mm. internal to the tip, indicates upon the outside scale by what amount the measured point lies within or beyond the spina,—e. g., in the figure it marks 53 less 50=3 mm. within. As the fossa often overhangs the spina, the reading may be negative by as much as the scale shows less than 50 mm. The same measurements may then be made upon the other side, without shifting the outside scale, by taking the difference between the two readings on the horizontal scale and subtracting 50 mm. The sliding caliper is made of such size as to serve for taking all the external dimensions of the skull; but these were quite generally taken with an ordinary pair of calipers, graduated in millimeters. The same were employed, with one branch introduced through the foramen magnum, to measure the distance between the sulcus and the mastoid surface or the back wall of the meatus—the latter measurement being rarely possible in a horizontal plane, as the instrument had to be so inclined that the plane of its tips sloped up and forward about 30°. Similarly the thickness of the bone between the sulcus and the exterior of the mastoid was slightly overestimated through measuring in a somewhat inclined plane. The small errors thus introduced were inconsiderable and fairly constant throughout the series.

In the detailed tabulation following, the crania are designated for purposes of identification by their museum numbers. In (C) College of Physicians, Philadelphia; (N) Academy of Natural Sciences, Philadelphia; (U) University of Pennsylvania; (A) United States Army and Medical Museum, Washington, and (P) private collections. The age, race, etc., are given as far as known, in the column of remarks.

Detailed data of measurements.

	Skull.	Length.	Breadth.	Index.	Height.	Parietal.	Mastoid.	Spina.	Sulcus.	Operation room.	M. S.	Thinnest point.	Back.	Fossa. High.	Fossa. Lat.	Larger. Sulcus.	Larger. Caput.	Remarks.
C	1,159.1	200	123	0.61	128	117	110	105	112	3	3	2	16	5	−2	R.	R.	White, adult male.
										6	10	5	10	5	3			
U	4,152	190	117	.61	138	116	118	112	114	17	20	11	23	9	6	L.	L.	Negro, adult.
										15	16	9	23	10	7			
U	75	192	119	.619	126	116	107	97	100	5	5	5	12	1	−3	L.	L.	
										2	2	2	2	2	−3			
N	422	194	129	.665	129	128	110	106	104	13	12	5	22	1	4	L.	L.	Negro, adult male.
										11	13	7	13	0	2			
U	4,009	196	131	.668	128	129	119	102	105	5	5	2	7	10	−1	L.	L.	Do.
										5	9	2	7	9	−1			
U	4,146	182	123	.67	124	122	122	116	100	12	15	7	12	10	2	R.	R.	
										10	15	7	12	7	2			
U	250	191	129	.67	128	117	111	103	109	2	1	1	21	3	−1	R.	R?	
										1	1	1	5	4	1			
A	2,612	187	128	.68	143	126	126	120	112	16	17	13	16	10	−2	L.	L.	French, adult.
										15	15	15	12	8	−2			
A	3,016	174	119	.68	120	134	121	113	110	8	8	5	18	6	−5	L?	R.	Dutch.
										12	12	8	18	4	−2			
C	34	196	135	.68	121	130	120	122	124	2	0	2	5	5	1	R.	R.	Tartar, adult male.
										7	10	4	10	10	4			
C	145	183	126	.68	133	127	114	109	109	13	14	7	19	8	1	L.	L.	Adult, massive.
										13	14	10	15	4	1			
U	255	190	131	.68	142	137	130	118	110	13	15	12	21	8	−7	R.	R.	Negro, adult.
										14	16	9	17	6	−7			
U	4,120	169	116	.68	119	104	116	111	116	12	12	10	20	6	3	L?	R.	Extreme intermastoid 127.
										12	15	9	20	10	3			
U	4,149	197	135	.68	132	131	113	109	117	1	2	1	5	5	0	R.	R.	
										9	10	6	8	8	2			
N	647	195	133	.68	141	129	118	115	112	11	14	5	21	3	7	Eq.	Eq.	Negro, African, adult.
										15	15	10	22	10	5			
N	963	182	125	.68	139	121	108	104	102	17	17	6	25	1	6	R.	R.	Do.
										17	17	7	25	3	5			
P	C.	183	128	.69	129	125	122	110	105	15	15	6	24	2	2	L.	L.	
										12	10	5	24	2	1			
N	1,245	186	130	.69	138	130	117	112	106	17	16	6	24	3	8	R.	R.	Mozambique, adult.
										15	15	7	19	3	8			
U	1,999	188	131	.69	129	129	123	117	115	11	12	6	16	5	0	R	R.	
										12	15	11	10	8	2			
U	3,888	198	138	.69	.....	.....	121	116	112	20	20	8	28	6	11	L.	L.	
										21	22	7	35	6	8			
U	4,153	196	136	.69	140	132	130	123	112	15	18	15	24	7	7	R.	R.	
										25	25	16	18	6	8			
U	4,180	191	133	.69	131	130	105	102	109	5	4	3	20	13	−2	R.	R.	Negro, massive.
										6	6	5	10	13	−2			


Glabella
Maximum Breadth
Meatus-Sulcus
Bi-Spinous
Bi-Mastoid
Operation-room
Bi-Sulcus
Parietal or Bi-Tuberal
Thinnest point
Occipital Protuberance

U	4,119	179	127	.709	132	116	124	115	105	12	12	10	18	6	7	L.	L.	Uruguay, adult.
										10	12	10	18	8	7			
U	270	171	120	.70	146	119	110	105	113	1	5	1	5	3	0	L.	L?	
										3	1	1	16	2	−1			
U	800	192	135	.70	134	133	125	123	117	15	16	15	5	8	1	L.	L.	Negro, adult.
										15	15	7	18	7	2			
U	37	191	135	.70	135	131	121	115	113	15	15	13	11	3	3	R.	R.	
										15	16	12	14	4	1			
U	80	197	139	.705	125	130	133	123	117	16	15	5	20	0	5	R.	R.	Aged French female.
										15	15	5	21	2	2			
U	52	185	131	.708	140	131	120	116	110	11	11	11	5	10	7	L.	R?	Peruvian, adult.
										12	13	11	10	11	7			
N	919	182	129	.70	131	125	116	110	116	15	15	9	21	5	21	Eq.	Eq.	African negro, adult.
										16	16	10	21	10	22			
N	978	190	133	.70	141	126	121	116	110	15	15	6	22	3	6	R?	R?	Do.
										15	15	6	22	4	6			
C	419	182	128	.70	121	123	108	103	112	10	11	3	12	1	5	Eq.	Eq.	Adult female.
										9	10	2	13	1	4			
C	200	225	158	.70	160	151	157	152	147	18	19	5	40	7	9	R.	R.	Kentucky giant, male.
										20	20	6	35	7	10			
C	413	179	127	.70	140	109	105	105	110	3	5	3	5	0	6	L.	L.	Adult.
										8	12	2	7	2	6			
U	4,010	187	132	.705	127	130	120	110	115	6	11	1	14	0	0	L.	Eq.	White, adult
										5	11	1	11	5	0			
U	63	196	140	.714	138	137	132	119	126	15	16	7	18	9	7	R.	R	Do.
										15	15	8	15	1	4			
U	97	196	140	.714	145	139	121	113	106	10	10	9	16	7	1	L.	L.	Negro, adult male.
										10	14	6	16	6	4			
U	22	181	130	.71	142	.....	124	110	118	10	10	5	20	14	1	R.	R.	
										10	8	4	22	14	−3			
U	03	174	125	.71	144	121	115	110	116	.3	.5	.3	5	4	0	R.	R.	French, adult.
										5	4	5	5	7	2			
C	405	204	146	.71	140	140	132	130	123	15	15	9	23	5	9	R.	Rhuge.	Indian, adult male.
										15	15	9	23	3	3			
C	1,188	195	137	.71	135	139	120	116	118	12	16	7	21	2	6	L?	R.	Young adult.
										11	15	8	20	2	8			
C	1,168	181	130	.71	135	130	117	111	109	10	11	7	12	9	3	R?	R.	Do.
										15	12	7	14	9	−1			
C	1,161.7	187	133	.71	133	138	117	112	111	12	12	6	11	5	8	L?	Eq.	Adult male.
										12	15	8	14	5	7			
A	55	192	137	.71	137	135	140	131	125	16	16	11	10	5	10	R.	R.	Aged white.
										18	16	8	23	5	9			
A	62	185	134	.724	128	133	118	110	110	6	6	9	4	3	−1	R.	R.	Adult, white.
										10	10	10	12	1	−1			
C	1,179	180	131	.72	.....	.....	108	104	103	13	15	10	19	1	8	L.	L.	Adult.
										8	10	7	10	1	9			
C	1,161.1	180	131	.72	138	131	117	104	109	10	12	5	20	4	9	L.	R.	Aged white.
										14	12	5	22	2	6			
N	920	179	130	.72	130	125	116	112	110	10	10	6	22	3	7	L.	L.	African negro, adult.
										10	10	6	18	4	6			
N	793	185	135	.72	136	135	118	120	110	5	5	3	20	2	1	R.	R.	Parsee.
										12	16	3	22	0	1			

Detailed data of measurements—Continued.

	Skull.	Length.	Breadth.	Index.	Height.	Parietal.	Mastoid.	Spina.	Sulcus.	Operation room.	M. S.	Thinnest point	Back.	Fossa. High.	Fossa. Lat.	Larger Sulcus.	Larger Caput.	Remarks
N	791	186	134	.72	146	134	122	116	106	17 16	17 16	9 11	23 23	7 5	8 7	R.	R	Armenian
N	762	184	134	.72	139	131	117	113	112	3 6	3 5	3 6	5 5	2 2	—3 2	R.	R.	Adult Circassian.
U	42	184	133	.72	143	133	112	112	107	16 15	15 16	10 11	20 20	4 5	2 0	R.	R.	Krooman.
U	62	188	137	.72	135	134	117	112	109	10 10	10 10	7 10	7 5	2 2	0 0	L.	R?	Negro, adult.
U	77	191	139	.72	142	136	126	119	117	9 12	12 16	6 7	9 16	5 0	4 2	R.	L.	Aged negro.
U	100	195	141	.72	87	140	119	106	107	10 11	12 15	8 10	20 16	7 7	—2 —1	L.	L.	Negro, adult.
U	241	170	123	.72	126	123	102	97	100	1 0	7 8	1 0	5 5	5 5	—3 —3	L?	R.	Do.
U	265	180	130	72	132	130	114	107	102	14 16	14 15	12 12	20 18	10 9	2 2	L.	L.	
U	1,649	185	135	.72	.....	.....	123	119	120	10 5	10 7	6 4	20 18	5 3	0 0	L.	L.	White, adult.
U	4,127	186	134	.72	139	131	122	119	109	17 15	16 15	7 10	20 20	6 7	9 7	R.	R.	Do.
U	4,129	179	130	.72	.....	.....	114	110	109	11 11	11 15	5 3	16 20	3 4	2 2	R.	L.	Sandwich Islander.
N	59	192	142	.73	150	130	122	117	115	11 11	11 11	4 6	22 22	2 2	—7 5	L.	L.	English convict.
N	421	188	139	.73	131	131	119	115	112	15 15	15 15	4 4	22 22	1 3	5 4	Eq.	R.	African, adult.
N	960	180	132	.73	132	131	113	111	107	12 15	12 15	6 5	21 22	3 3	6 4	L?	L.	African negro.
N	962	183	135	73	135	129	116	111	112	18 15	17 15	4 6	27 26	1 4	4 4	R.	R.	Do.
N	968	185	136	.73	142	136	116	111	112	15 15	15 16	5 6	23 22	2 2	7 5	R.	R	Do
N	985	188	139	73	145	139	123	120	115	11 11	12 12	4 4	28 28	2 2	8 7	R.	R	Celtic, adult
U	06	192	142	.73	136	142	122	125	115	15 10	19 16	8 8	25 20	8 8	3 3	L.	R?	Negro, adult.
U	38	171	126	.73	131	121	108	104	110	14 8	15 12	4 3	13 15	1 1	0 0	R.	R	Krooman, adult.
U	91	182	133	.73	130	133	115	112	107	10 11	10 12	7 6	19 16	12 11	1 1	R.	R	Hindoo, adult female.
U	92	197	144	.73	127	134	130	124	113	13 10	14 12	8 7	20 14	8 9	3 5	L.	L.	Anglo-American, adult.
U	1,997	187	138	.73	131	134	118	114	119	11 15	15 15	4 7	21 18	8 9	9 3	R?	R	White, adult, syphil

U	3,960	190	140	.73	144	132	133	129	115	15	15	13	6	5	7	R.	R.	American Indian, adult
										15	15	15	5	6	7			
U	4,118	192	141	.73	140	140	120	115	123	11	15	10	14	6	0	R?	R?	
										9	11	7	12	1	5			
U	4,121	180	132	.73	128	130	119	111	108	11	11	5	19	7	5	R.	R.	
										10	10	6	19	7	7			
U	01	190	140	.73	134	136	119	114	111	11	15	5	21	4	6	R.	R	Aged adult.
										15	16	6	22	6	2			
C	51	186	137	.73	123	135	109	104	106	6	6	5	18	2	—4	R.	R.	Greek, adult.
										5	6	4	10	3	—4			
C	317	191	140	.73	122	130	124	120	110	15	15	10	22	3	7	R.	R.	Sioux, adult.
										15	15	11	22	2	6			
C	351	190	139	.73	144	138	123	119	114	9	10	6	16	2	6	R?	R.	Adult male.
										13	15	9	17	1	4			
C	402	175	12[illegible]	.73	122	122	110	105	105	9	10	3	20	0	7	R.	R.	Senile, female
										9	10	3	20	1	4			
C	403	197	144	.73	140	140	128	129	124	7	7	6	20	4	4	R.	R.	Negro?, adult.
										10	10	10	5	5	3			
C	414	174	128	.73	108	127	119	103	110	10	11	4	14	3	1	R.	R.	Young adult.
										10	11	5	19	2	3			
C	1,155.1	196	145	.73	140	143	122	116	118	10	10	6	12	4	8	Eq.	L.	White, adult.
										10	11	5	14	0	6			
A	59	193	141	.73	139	141	119	112	110	10	9	9	7	5	—1	L.	L.	Do.
										10	10	9	6	3	2			
A	64	192	141	.73	130	137	124	117	115	8	9	8	12	7	12	R.	R	Do.
										6	7	7	6	7	6			
N	1,101	182	136	.74	135	133	116	110	105	14	13	5	23	2	6	L.	L.	Eboe.
										11	11	5	21	1	5			
N	1,532	181	135	.74	129	133	120	115	112	9	10	5	21	2	6	L.	L	Cimbric, anc
										10	11	5	19	3	3			
U	57	192	143	.74	131	139	132	124	119	15	15	9	19	8	5	L.	L.	
										11	12	4	12	6	2			
U	59	181	135	.74	130	131	123	111	107	11	12	6	20	10	3	R.	L?	European, female, 18.
										13	14	7	20	3	1			
U	90	175	130	.74	130	125	113	107	104	10	11	4	18	8	3	R.	R.	Hindoo, adult.
										9	11	4	16	5	0			
U	02	179	134	.74	----------	----------	116	111	120	6	7	2	12	12	0	R.	R	
										10	10	6	18	12	2			
U	08	175	131	.74	132	127	115	111	110	13	14	8	22	7	—1	L.	L.	Indian, adult.
										11	12	6	20	4	0			
U	2,171	182	135	.74	140	128	128	112	113	11	15	7	20	8	7	L.	L.	
										15	16	10	18	6	4			
U	3,970	191	143	.74	131	135	116	117	117	7	10	5	12	5	1	R.	L.	White, adult.
										9	10	6	6	5	2			
U	4,006	197	147	.74	125	142	129	122	116	11	14	15	14	4	2	L?	L.	Irish, adult.
										5	9	2	13	3	0			
U	4,117	179	133	.74	122	127	108	105	106	10	10	6	17	5	—2	L?	L.	Mulatto.
										11	12	2	16	4	—1			
U	4,147	185	135	.74	131	128	125	123	111	10	11	7	20	7	5	R.	R.	
										11	11	10	19	4	5			
U	4,159	188	140	.74	136	135	123	117	109	15	15	6	22	8	0	R.	R.	Aged adult.
										15	16	5	21	4	1			

Detailed data of measurements—Continued.

	Skull.	Length.	Breadth.	Index.	Height.	Parietal.	Mastoid.	Spina.	Sulcus.	Operation room.	M. S.	Thinnest point	Back.	Fossa. High.	Fossa. Lat.	Larger. Sulcus.	Larger. Caput	Remarks.
7	4,320	160	119	.74	120	115	113	111	108	10 11	5 10	6 6	20 20	6 6	5 4	L.	R.	New Hebrides.
C	18	187	140	.74	130	140	125	121	117	13 15	16 15	10 7	16 16	11 12	4 3	L?	R.	Gipsy, male, 24.
C	38	175	137	.74	125	125	108	104	106	3 1	4 .2	2 1	7 5	4 6	—4 —3	L.	L.	Caucasian.
C	57	191	143	.74	137	140	130	125	113	15 13	15 12	10 9	20 11	13 12	4 5	L.	L.	Greek, male.
C	131	185	137	.74	135	128	127	122	110	20 17	20 20	12 9	14 20	10 11	—1 2	L.	L.	Bohemian.
C	300	184	137	.74	136	131	124	120	120	13 10	14 10	10 6	25 19	5 3	6 2	L.	L.	Young adult.
C	303	182	135	.74	147	135	122	117	108	13 15	15 15	7 7	21 22	4 4	6 9	R.	R.	Mound-builder.
C	406	194	145	.74	144	141	127	124	111	15 13	15 15	15 13	5 5	3 5	6 6	R.	R.	Indian, aged.
C	418.1	170	126	.74	130	120	112	109	107	10 12	11 15	6 6	18 21	6 6	1 1	Eq.	Eq.	Adult female.
C	490	182	136	.74	130	133	120	115	117	10 10	16 9	7 7	16 10	5 5	5 5	L?	L?	Adult, white.
C	1,169.3	185	137	.74	130	125	112	110	106	10 9	8 12	5 5	19 16	8 7	2 —4	Eq.	Eq.	White, male, old.
C	1,169.9	193	144	.74	136	136	129	122	122	11 10	12 10	5 5	20 19	8 5	5 0	Eq.	Eq.	Aged adult.
C	1,169.20	177	132	.74	123	131	117	111	115	10 11	13 15	4 7	13 14	3 0	5 2	L.	L.	Negro, adult.
C	1,177	187	139	.74	126	136	117	114	112	9 10	10 10	7 6	11 12	8 1	4 —1	R?	L.	Old man.
C	561	193	144	.74	141	144	133	120	126	11 11	11 10	11 10	10 10	8 5	0 3	R	R	White, adult.
A	2,118	188	139	.74	141	136	128	121	126	10 14	10 12	19 11	13 13	12 11	3 5	L?	R.	Do.
N	33	188	141	.75	126	134	122	120	114	18 10	15 10	10 6	25 19	0 2	7 2	L?	R.	French, aged 60.
N	539	188	142	75	131	136	120	113	116	10 10	11 11	3 5	24 20	3 2	—2 —2	R.	R.	English, adult.
N	911	176	133	.75	135	128	111	106	111	15 15	16 16	2 4	22 22	1 0	9 5	Eq.	Eq.	African, negro.
N	915	181	137	.75	129	127	123	116	119	12 11	13 12	2 4	22 22	3 3	7 5	R.	R.	Do.
N	919	182	138	75	147	132	122	116	124	11 6	12 10	4 3	20 20	3 1	6 4	L?	L.	Do.
N	926	174	132	.75	131	126	110	105	109	11 12	10 15	3 5	22 22	0 3	7 5	R.	R.	Do.

										11	14	3	22	3	3	L.	L?	Do.	
N	1,082	186	140	.75	135	134	122	118	121	6	6	2	7	4	−3	R.	R.	French, male, 45.	
										12	12	3	21	4	1				
N	1,186	175	132	.75	127	126	106	103	103	10	12	4	22	3	−2	R.	R.	Irish, young adult.	
										10	11	3	21	3	0				
N	1,247	182	137	.75	130	128	120	115	110	12	12	3	23	4	0	R.	R.	Swede, young adult.	
										15	15	4	23	1	1				
N	1,547	190	143	.75	141	140	132	128	122	10	9	4	27	7	2	R.	R.	Swede, old adult.	
										12	11	5	29	7	5				
U	36	178	135	.75	141	132	121	117	118	9	11	5	13	8	2	R.	R.	American Indian.	
										11	12	6	12	5	5				
U	41	174	131	.75	124	131	108	104	105	11	12	6	18	4	2	R?	R?	Krooman, adult.	
										11	12	6	18	2	2				
U	54	166	125	.75	131	122	104	103	107	7	11	7	5	9	2	L.	L.	Negro, adult.	
										6	10	5	10	6	1				
U	74	170	128	.75	112	125	119	110	115	5	10	3	11	0	1	R.	R.	Aged woman.	
										8	8	3	10	2	0				
U	85	180	136	.75	146	136	119	115	117	11	11	5	16	9	6	R.	R.	Chinese, adult.	
										10	12	4	12	6	5				
U	090	187	142	.75	138	140	122	121	122	10	12	4	21	3	3	Eq.	R?	Negro, adult.	
										11	15	6	20	2	4				
U	203	178	135	.75	130	132	108	103	114	1	11	.5	7	3	−4	L?	R.	Male, 15 years.	
										5	10	1	8	2	−3				
U	231	174	132	.75	.....	.....	115	115	117	10	9	5	12	10	0	L.	L.	Adult.	
										10	10	3	16	10	3				
U	273	182	138	.75	128	135	128	118	115	5	5	5	5	4	0	L.	L.		
										10	11	5	12	3	0				
U	4,115	182	137	.75	140	137	120	118	114	16	17	3	23	7	5	L.	L.		
										15	16	7	20	9	5				
U	4,116	187	142	.75	133	140	120	111	107	16	16	10	20	7	5	R.	R.	Aged negro.	
										16	15	9	22	7	2				
U	4,124	162	122	.75	124	120	108	102	102	8	10	3	20	6	6	R.	R.	Anglo-American, female, adult.	
										8	11	3	20	4	3				
U	4,145	192	144	.75	141	141	135	124	116	11	12	6	18	13	−2	L.	L.		
										14	14	6	18	12	6				
U	4,148	185	140	.75	139	138	121	112	112	12	14	10	21	8	−1	L.	L.		
										15	15	10	16	7	3				
U	4,154	183	138	.75	133	135	123	120	108	13	12	13	5	9	2	L.	L.	Guanache.	
										8	8	5	10	6	2				
U	4,157	186	141	.75	131	139	122	118	107	10	11	7	11	8	1	R.	R.	Old adult.	
										10	11	10	5	6	4				
U	4,161	191	145	.75	144	145	121	116	112	10	12	10	5	9	2	R.	R.	Adult, male.	
										12	12	10	16	8	3				
U	4,162	192	144	.75	.....	.....	114	110	117	5	5	5	5	4	−1	L.	L.		
										3	3	3	5	5	1				
U	4,316	189	143	.75	135	143	122	117	115	15	16	7	10	5	6	R.	R.	Aged negro.	
										16	16	10	18	4	1				
C	0	182	138	.75	141	136	120	114	113	14	16	8	11	5	−2	Eq.	L.	White adult, male.	
										11	16	11	14	5	3				
C	9	183	139	.75	133	138	112	110	109	10	12	6	12	10	−5	L.	L.	Holland, adult, male.	
										15	15	8	16	8	1				

Detailed data of measurements—Continued.

	Skull.	Length.	Breadth.	Index.	Height.	Parietal.	Mastoid.	Spina.	Sulcus.	Operation room.	M. S.	Thinnest point	Back.	Fossa. High.	Fossa. Lat.	Larger. Sulcus.	Larger. Caput.	Remarks.
C	54	178	134	.75	132	134	120	124	113	10 10	11 11	9 7	16 11	8 8	1 0	L.	L	Cretan male.
C	104	188	142	.75	145	140	120	113	112	9 10	15 15	7 5	19 18	9 10	1 2	Eq.	R?	Russian.
C	307	175	122	.75	142	132	112	110	108	10 10	11 11	3 4	20 20	3 3	6 5	R.	R.	Mound-builder.
C	326	180	135	.75	145	132	121	118	109	14 14	14 14	5 5	24 28	1 7	6 6	R.	R.	Do.
C	1,145.5	192	145	.75	138	140	126	120	122	13 12	11 11	5 5	22 20	9 6	5 0	L.	L.	Adult, male.
C	1,169.4	181	137	.75	.....	135	124	117	122	6 6	10 10	4 3	19 17	6 4	1 4	L?	R.	
C	1,169.7	177	133	.75	134	130	115	111	117	10 8	13 11	7 4	10 12	6 9	2 2	L?	L.	Adult, female.
A	38	174	132	.75	138	130	123	114	111	10 7	10 10	7 8	9 9	6 2	2 3	L?	L.	White, young adult.
A	52	186	140	.75	142	138	130	118	110	16 15	16 15	10 10	18 22	6 6	4 4	R?	R?	White, adult.
A	53	197	149	75	143	144	128	120	120	10 11	10 11	10 10	14 11	4 3	4 0	R.	R.	Do.
A	637	179	136	75	126	131	123	120	110	11 12	12 14	10 17	20 14	7 0	2 5	R.	R.	Do.
A	2,119	181	136	.75	135	134	124	119	110	10 15	12 15	9 13	14 12	7 7	3 1	L.	L.	Do.
A	1,978	181	137	.75	133	132	124	120	117	10 10	13 15	6 7	18 19	11 6	5 2	Eq.	Eq.	Bavarian, female, 75.
N	21	181	138	76	144	132	129	126	112	15 16	16 17	6 7	26 26	7 7	7 7	L.	R.	Irish, adult.
N	800	171	131	.76	120	129	106	102	103	6 5	10 6	3 3	20 10	8 5	0 0	L.	Eq.	Armenian, adult, female.
N	964	184	141	.76	132	133	125	123	118	12 15	14 15	3 5	21 22	5 4	4 4	R.	L.	African, negro, adult.
N	973	184	141	.76	134	140	113	109	112	8 10	8 10	4 3	22 21	4 3	1 1	L?	R.	African, negro.
Pr	64	176	135	.76	131	134	116	111	112	10 10	12 13	5 5	16 18	7 6	2 0	R.	R.	Negro, adult, male.
U	78	169	129	.76	123	124	117	107	95	12 15	15 16	7 8	22 23	6 5	4 4	L.	L.	Aged Anglo-American.
U	246	184	140	.76	140	138	126	113	110	10 10	12 11	3 6	16 12	6 5	3 5	R.	R	
U	274	177	136	.76	131	134	116	114	108	16 12	16 15	10 7	22 19	7 4	4 2	L.	L.	
U	3,926	194	148	.76	143	130	124	118	121	10 9	10 10	5 3	10 10	5 5	1 0	L?	L.	Sandwich Islander.

C	4,158	185	142	.76	141	138	130	124	105	13	14	7	20	9	6	R?	R.	Young adult.
										16	17	9	20	11	7			
C	2	184	140	.76	140	139	123	117	113	10	15	5	19	10	2	L?	L?	Austrian, male, 29.
										7	11	5	16	9	1			
C	023	182	139	.76	142	137	119	117	112	15	16	8	22	6	—2	L.	L.	
										14	16	1	22	4	1			
C	128	180	138	.76	130	136	115	109	107	15	15	5	22	11	3	R.	R.	Egyptian.
										16	15	6	22	5	0			
C	329	178	136	.76	146	133	121	114	114	11	11	5	23	5	3	R.	R.	Mound-builder, adult
										11	11	5	20	2	4			
C	355	178	136	.76	127	130	119	112	110	12	12	10	19	5	0	R.	R.	Negro, adult, female.
										15	15	10	19	5	3			
C	400	189	145	.76	127	138	135	124	120	10	11	6	16	2	—5	R.	R.	White, adult.
										15	15	7	30	1	—2			
C	404	186	142	.76	125	136	127	119	120	3	6	3	5	2	12	R.	R.	White, senile.
										14	15	9	19	0	4			
C	1,151.4	186	143	.76	147	138	124	116	121	10	12	3	21	4	2	L.	L.	
										10	12	2	19	2	0			
C	1,165.1	186	143	.76	132	140	127	121	116	12	12	10	15	8	1	L.	R.	
										17	16	10	13	7	0			
C	1,169.5	178	137	.76	134	136	121	116	109	11	14	10	6	6	2	R?	R.	White, adult.
										12	15	11	13	3	3			
A	1,843	171	130	.76	122	127	115	110	102	8	11	5	18	14	6	R.	R.	Aztec, female.
										11	14	7	14	10	3			
A	1,971	187	143	.76	131	134	119	115	117	8	5	5	16	4	—1	R?	R?	Austrian, male, 65.
										12	8	6	17	6	2			
A	2,416	177	135	.76	135	134	123	114	102	13	15	11	20	6	0	R.	R.	Alaskan Indian.
										15	13	8	18	4	2			
A	2,668	177	136	.76	142	128	127	121	110	16	16	10	21	8	4	L.	L.	Do.
										15	15	11	22	8	5			
N	765	174	134	.770	130	130	114	113	106	15	15	4	30	0	8	Eq.	R.	Circassian.
										17	17	4	25	5	5			
N	904	174	134	.770	133	132	116	114	116	11	11	5	22	13	4	L.	L.	African, negro.
										8	10	3	22	11	4			
U	249	192	148	.770	138	144	121	115	120	1	1	6	10	5	3	R.	R.	
										1	5	5	6	3	1			
U	264	179	138	.770	126	130	125	120	110	16	15	10	10	10	5	R?	R?	Old adult.
										13	13	10	20	10	5			
U	744	179	138	.770	149	132	100	97	111	4	5	1	14	2	0	L.	L.	Negro, 18.
										1	1	.5	16	2	—3			
U	3,893	179	138	.770	132	135	126	118	119	12	10	6	22	8	3	R?	R?	
										11	11	3	16	4	3			
U	4,156	183	141	.770	131	138	124	116	113	7	12	7	5	8	2	Eq.	L?	Aged adult.
										8	13	8	5	8	3			
A	57	183	141	.770	130	139	116	112	108	10	16	9	12	7	1	R.	R.	White, adult.
										10	16	10	5	5	2			
A	2,069	183	141	.770	130	139	125	123	110	11	21	7	19	7	0	R.	R.	Sioux Indian.
										11	15	9	21	6	0			
C	112	174	134	.770	131	133	113	109	103	8	7	1	21	1	2	R.	R	Italian, male, 17.
										8	9	2	21	1	0			

Detailed data of measurements—Continued.

	Skull	Length.	Breadth	Index.	Height.	Parietal.	Mastoid.	Spina.	Sulcus.	Operation room.	M. S.	Thinnest point	Back.	Fossa. High.	Fossa. Lat.	Larger. Sulcus.	Larger. Caput.	Remarks.
C	53	188	145	.771	134	141	131	125	122	7	10	5	20	3	0	R.	R.	Greek, male.
										11	12	6	16	3	1			
A	1,966	175	135	.771	128	120	121	116	111	10	12	8	14	2	2	L?	L	Austrian, female, 20.
										11	12	8	20	2	−1			
N	903	185	143	.772	147	143	119	116	116	12	13	3	24	6	4	R?	R.	African negro.
										15	16	5	24	5	1			
U	3,876	193	149	.772	135	143	134	130	120	15	15	10	22	9	4	R.	R.	Indian adult.
										15	19	10	20	9	4			
U	3,969	180	139	.772	147	137	124	120	115	2	2	0	6	3	0	R.	R.	Sandwich Islander.
										15	15	15	5	7	3			
C	325	167	129	.772	135	126	118	111	104	12	12	5	22	6	5	R.	R	Mound-builder, s.
										15	15	10	20	3	7			
C	11,613	180	139	.772	123	132	121	121	112	11	11	6	14	11	1	R.	R?	Adult, syphilitic.
										14	15	7	12	10	0			
C	105	172	133	.773	130	127	124	116	108	9	11	9	23	2	5	L.	R?	Caucasian.
										15	15	5	21	2	4			
C	140	181	140	.773	140	137	123	115	109	11	14	8	16	10	3	L?	Eq.	Chinese, female.
										15	13	11	10	7	2			
N	1,487	172	133	.773	125	128	116	109	111	12	12	5	20	2	5	Eq.	R.	Swede, adult, female.
										15	14	8	20	1	7			
N	1,548	190	147	.773	134	142	130	127	120	15	15	7	21	6	0	R.	R.	Swede.
										14	15	6	21	3	0			
N	244	177	137	.774	127	132	119	114	116	10	10	4	21	2	−2	L?	Eq.	Adult.
										9	9	5	21	2	−1			
C	126	173	134	.774	129	133	124	115	106	19	16	7	21	8	1	R.	L.	Female, 21.
										17	15	14	17	6	−4			
C	1	183	142	.775	142	138	127	124	119	15	12	6	18	8	2	R.	R.	Young adult.
										15	12	8	16	8	2			
C	36	183	142	.775	133	142	127	120	116	14	15	7	18	10	1	R?	R.	Cashmere, male, 36.
										15	15	6	18	6	2			
U	73	178	138	.775	141	137	116	113	107	15	15	6	16	9	6	L.	L.	Negro adult.
										15	15	6	16	5	3			
A	2,138	184	143	.777	143	133	130	126	116	12	16	7	20	9	5	R.	R.	Nez Percé Indian.
										14	15	8	21	4	0			
U	84	180	140	.777	135	138	121	114	118	12	12	5	20	3	3	R.	R.	Chinese, adult.
										15	14	10	20	1	1			
U	88	166	129	.777	119	128	94	97	105	10	10	2	20	5	0	L?	L?	Chinese, male, 14.
										6	10	2	16	3	0			
U	209	189	147	.777	143	142	138	119	119	17	16	10	15	5	1	L.	R.	
										17	16	8	15	5	1			
U	3,894	203	157	.77	.....	157	138	114	127	6	8	5	16	7	0	L.	L.	
										6	7	4	20	7	0			
C	1,167.10	171	133	.777	131	132	105	101	103	12	15	6	17	6	2	R?	Eq.	Negro, female.
										10	12	6	11	5	0			

C	111	180	140	.777	130	128	121	119	118	7	6	5	12	5	2	R.	R.	Italian, male, 60.
										7	8	6	19	2	0			
C	1,183	180	140	.777	113	137	120	115	118	10	11	2	19	6	2	R.	R.	
										12	12	5	18	3	2			
U	39	185	144	.778	139	142	126	122	118	16	15	10	20	9	5	L.	L.	Krooman, adult.
										12	10	7	18	5	1			
U	213	230	179	.778	154	179	124	121	117	12	15	6	20	3	0	R.	R.	
										14	15	7	20	2	0			
C	21	177	138	.779	138	130	125	119	123	10	12	6	19	3	1	R?	R.	
										10	15	6	15	6	2			
C	98	172	134	.779	135	130	131	125	104	15	14	9	24	5	2	R.	R.	Tassig, 37 years.
										15	12	10	22	8	2			
A	2,112	181	141	.779	131	135	133	124	123	11	14	11	5	6	+1	R.	R.	White, adult.
										10	11	9	6	5	−2			
A	2,244	181	141	.779	138	134	137	123	121	16	17	15	14	8	5	R.	R.	Do.
										17	16	18	22	8	5			
N	1,545	192	150	.78	135	143	130	123	125	10	14	4	21	4	0	R.	R.	Finn, young adult.
										10	11	5	21	3	0			
N	7,117	185	145	.78	124	138	125	118	120	11	11	6	16	7	1	RL.	R.	Swede.
										13	11	6	21	3	0			
U	.05	170	134	.78	.....	.....	116	113	112	10	10	5	22	4	2	L.	L.	French, young adult.
										10	10	5	11	5	2			
U	.09	174	137	.78	138	131	123	118	118	11	12	4	12	4	5	R.	R.	Aged negro.
										6	12	6	5	4	5			
U	.81	178	140	.78	124	132	119	115	115	10	11	2	20	7	1	R.	R.	
										11	14	3	18	4	−3			
U	.86	187	146	.78	130	134	122	116	117	11	12	6	20	7	1	R?	R.	Chinese, adult.
										11	11	10	7	7	−2			
U	254	181	142	.78	145	141	128	122	112	15	16	3	4	5	3	R?	R.	
										15	16	10	22	8	4			
U	269	188	148	.78	141	146	125	120	125	15	15	7	22	7	0	L.	R.	Aged adult.
										15	15	5	22	11	1			
U	1,927	181	142	.78	130	141	112	109	112	12	10	3	22	11	2	L.	L.	
										10	7	3	12	11	2			
U	1,928	185	145	.78	136	138	115	112	112	10	8	5	14	12	0	L?	L.	Senile, fractured.
										8	8	6	10	10	0			
U	3,918	182	142	.78	137	139	120	115	112	15	15	4	26	6	4	L?	L?	Aged, white.
										15	15	6	22	9	4			
U	4,008	184	145	78	136	141	126	123	112	12	12	10	20	4	2	R.	R.	Do.
										10	10	10	5	4	2			
C	12	183	143	.78	137	143	125	119	113	15	15	10	20	8	−3	R.	R.	Marmarosal, male, 80.
										16	15	11	20	12	0			
C	14	185	145	.78	142	143	123	118	117	13	11	6	16	6	−1	Eq.	Eq.	Hungarian, male, 34.
										11	15	8	16	5	1			
C	19	166	131	.78	127	128	106	100	106	10	10	5	12	9	−5	R.	R.	Ruthene, male, 12.
										10	15	3	14	7	−3			
C	31	176	138	.78	140	136	124	118	116	12	11	7	12	11	8	R?	R.	Gypsy.
										15	12	6	16	12	8			
C	32	178	139	.78	135	133	125	120	112	15	18	6	17	18	7	R.	R.	Finlander, male, adult.
										17	13	10	14	13	5			
C	37	175	137	.78	122	128	131	127	117	15	15	6	21	9	3	R.	R.	Padolean, male, 35.
										12	14	6	18	8	5			

Detailed data of measurements—Continued.

	Skull.	Length.	Breadth.	Index.	Height.	Parietal.	Mastoid.	Spina.	Sulcus.	Operation room.	M. S.	Thinnest point	Back.	Fossa. High.	Fossa. Lat.	Larger Sulcus.	Larger Caput.	Remarks.
C	76	178	140	78	128	134	121	118	118	10 12	10 11	4 6	16 16	7 6	−2 0	R.	R.	Saxon, male, 36.
C	99	173	136	.78	133	131	128	121	116	10 12	13 12	6 5	20 16	6 4	2 −2	L.	R.	Armenian, 29.
C	108	181	142	.78	131	141	120	116	112	10 9	15 12	4 2	22 22	5 5	1 1	L.	L.	Italian, male, 14.
C	127	173	136	.78	123	131	125	119	109	9 15	12 15	6 10	15 16	5 6	2 3	R.	R.	Turk, adult, male.
C	304	176	138	.78	142	132	126	122	112	15 13	15 13	6 9	24 24	8 8	5 5	Eq.	R.	Mound-builder, adult.
C	305	170	134	.78	153	134	125	123	115	13 14	15 15	6 10	30 20	7 7	5 5	R.	R.	Do.
C	314	178	140	.78	147	137	132	128	112	16 16	15 16	11 11	26 29	7 7	4 4	L.	L.	Indian, adult.
C	352	187	146	.78	145	141	124	120	123	6 15	7 15	3 6	24 22	1 3	1 −1	R.	R.	Adult, male.
C	356	185	145	.78	125	140	125	121	123	10 15	11 15	5 5	21 21	1 2	4 −3	R.	R.	Indian, adult, male.
C	418	187	146	.78	135	139	127	122	121	12 14	11 14	4 5	24 24	0 1	7 2	R.	R.	Male, 30.
C	484	184	144	.78	138	140	116	112	112	16 15	16 16	7 8	22 22	1 4	−7 5	Eq.	R.	White, adult.
C	1161	192	150	.78	136	139	135	133	128	12 10	14 13	4 4	22 21	9 9	1 1	R.	R.	
C	1155	175	138	.78	133	137	115	111	117	11 9	15 14	1 2	13 13	4 4	2 0	R.	R.	Do.
C	1178	175	138	.78	127	131	120	116	117	11 11	13 15	5 5	17 17	8 8	4 5	R?	Eq.	Adult.
C	1182	182	142	78	127	137	122	118	121	7 10	6 10	3 5	18 18	4 3	2 1	R.	R.	
C	11825	172	134	.78	123	134	114	108	110	7 12	11 12	4 6	15 16	8 6	1 2	R?	R.	
C	3105	169	132	.78	140	127	124	115	110	16 14	15 15	10 6	22 24	6 4	8 5	R.	R.	Mound-builder, adult.
A	56	183	143	.78	132	141	120	114	110	10 6	10 6	9 5	12 8	10 10	2 2	R?	R.	White, adult.
A	63	193	152	.78	140	150	123	117	117	11 11	10 17	6 14	18 10	7 6	3 2	L?	R.	Do.
A	1334	179	140	.78	130	130	123	114	106	11 12	12 13	10 11	18 18	7 7	3 5	L.	L.	California Indian
A	1336	174	137	.78	132	136	120	118	105	10 9	11 15	8 7	16 16	11 11	5 5	L.	L.	Do.
A	1962	180	141	.78	124	133	136	126	120	8 11	9 11	7 9	18 22	5 2	−2 −2	R.	R.	Austrian, male, 50.

A	1968	177	139	.78	137	134	125	119	109	14 15	14 15	11 11	19 17	7 8	2 2	R?	R?	Austrian, male, 45.
P	E.	182	145	.79	126	145	119	114	108	7 6	11 7	7 6	5 5	6 3	1 −2	L	L.	Adult.
U	3	173	137	.79	126	136	126	114	113	10 8	8 8	5 3	8 10	0 2	1 0	R.	R	Aged female.
U	87	178	141	.79	130	135	123	119	109	10 12	11 12	4 10	21 14	7 4	4 4	R?	R?	Chinese, adult.
U	256	178	142	.79	135	141	122	119	113	15 15	15 15	7 9	20 10	10 8	5 3	R.	R.	
U	266	172	137	.79	127	131	128	112	111	15 12	15 14	6 5	20 18	4 6	−2 −2	L.	R.	
U	4155	178	141	.79	126	138	122	116	110	10 10	10 10	5 5	18 18	8 8	3 3	L.	L.	
A	1330	183	145	.79	137	143	127	124	119	12 12	12 14	9 10	19 16	3 8	−2 7	R	Eq.	California Indian.
A	1,756	186	148	.79	141	147	136	130	118	16 16	16 15	15 11	21 18	10 6	5 4	L?	R.	White, adult.
A	2,418	180	143	.79	137	132	127	125	117	10 13	12 13	5 9	20 18	5 4	0 2	R?	L.	Alaska Indian.
C	10	164	131	.79	113	135	115	111	110	8 13	10 14	2 8	20 18	1 6	−4 −3	R?	R.	Hollander, female, adult.
C	44	183	146	.79	129	145	116	111	120	12 15	15 16	7 6	20 20	12 12	0 0	L.	L.	Piedmont, male, 23.
C	55	186	148	.79	134	144	134	129	125	19 9	13 20	10 3	25 12	10 6	5 5	R.	R	Greek, male
C	61	182	144	.79	130	142	123	120	116	15 15	15 15	5 6	16 20	11 10	4 0	R.	R	Austrian, male, 16
C	70	177	141	.79	126	137	115	114	115	12 12	15 15	7 4	18 17	11 8	2 2	R?	L?	Hungarian, male, 23
C	81	180	143	.79	135	135	129	123	114	16 14	15 16	7 6	21 20	9 6	4 4	L.	L	Pole, male, 46
C	85	180	143	.79	129	137	124	119	113	10 5	11 8	6 5	17 5	7 6	0 5	Eq.	Eq.	Wende, female, 23.
C	91	175	139	.79	133	137	123	110	111	7 12	11 12	7 11	5 14	9 9	5 3	R.	Eq.	Bosnian.
C	110	178	141	.79	127	139	125	116	109	12 10	11 11	6 5	23 20	9 5	3 2	R.	R.	Italian, male, 18.
C	122	193	153	.79	130	150	127	125	120	9 8	12 12	6 7	18 6	6 5	0 −1	L.	L.	Druse, adult, male.
C	123	185	147	.79	139	139	125	129	123	15 15	15 15	5 7	22 22	6 5	1 0	R.	R.	Albanian, adult, male.
C	302	169	135	.79	135	135	113	112	108	13 14	14 15	4 5	21 21	5 4	3 5	R.	R.	Mound-builder, adult.
C	409	188	150	.79	122	140	140	135	130	12 10	11 8	5 6	18 20	7 2	1 2	L.	L.	Adult.
C	1,161.2	193	153	.79	135	130	135	133	130	13 10	15 15	5 5	19 19	5 3	2 2	R.	R.	Senile, adult.
C	1,161.11	169	134	.79	126	130	114	112	114	8 10	7 11	5 5	16 16	3 3	1 1	Eq.	Eq.	Adult, syphilitic.
C	1,672.20	169	134	.79	139	134	129	117	118	14 11	17 13	6 7	20 19	6 5	2 2	R.	R.	Negro.

Detail data of measurements—Continued.

	Skull.	Length.	Breadth.	Index.	Height.	Parietal.	Mastoid.	Spina.	Sulcus.	Operation room.	M. S.	Thinnest point	Back.	Fossa. High.	Fossa. Lat.	Larger. Sulcus.	Larger. Caput.	Remarks.
P	F.	181	146	.80	132	137	126	122	115	15	11	7	20	5	3	L?	L.	Adult.
										10	10	7	10	6	3			
P	W.	191	154	.80	142	149	142	132	117	16	17	10	25	7	5	L.	L.	White, adult.
										20	20	8	22	5	0			
N	1,450	173	140	.80	130	138	127	123	120	10	9	4	21	3	2	R.	R.	Swede, adult, male.
										15	15	2	25	4	1			
U	04	185	148	.80	132	148	122	119	117	10	11	3	22	7	1	R.	R.	French, adult.
										10	10	4	20	8	3			
U	64	160	128	.80	130	110	109	102	108	7	10	1	21	8	3	R.	R.	Negro, 16 years.
										10	11	4	12	6	0			
U	4,125	173	139	.80	141	135	120	116	112	6	6	3	16	1	4	R.	R.	Chinese, adult.
										4	5	3	13	1	2			
A	120	190	152	.80	135	133	130	121	125	16	15	10	12	4	—5	L.	L.	Aged white.
										16	15	6	18	1	—3			
A	1,016	180	145	.80	132	142	133	126	119	12	12	5	20	7	—1	R.	R.	Sioux Indian, male 55.
										12	12	4	21	4	2			
A	1,020	168	136	.80	126	129	125	120	109	10	12	5	21	7	0	R.	R.	Modoc Indian, 40.
										11	11	8	19	5	4			
A	1,979	181	137	.80	133	132	124	120	117	10	13	6	18	11	2	Eq.	Eq.	Bavarian, female, 75.
										10	15	7	19	6	2			
C	21	174	140	.80	123	137	120	116	112	12	15	5	12	6	—3	R?	L?	Lithuanian, female, 17.
										12	15	6	14	10	—2			
C	22	184	148	.80	133	143	136	129	120	11	11	6	19	8	2	R.	R.	Pole, 26.
										12	12	5	21	8	5			
C	30	177	142	.80	148	138	125	120	122	4	7	4	5	8	0	R.	R.	Syrian.
										1	1	1	1	6	1			
C	47	192	154	.80	145	154	130	122	123	9	11	4	13	9	0	Eq.	R.	Italian, male, 37.
										5	10	3	8	10	0			
C	52	166	132	.80	124	130	129	123	105	15	11	7	16	3	2	R?	R.	Microcephalic, male.
										12	11	5	18	6	3			
C	68	182	146	.80	134	147	119	112	106	10	10	5	21	10	0	R.	R.	Schleswig, male, 40.
										14	11	10	12	9	0			
C	72	175	140	.80	133	140	130	126	116	12	15	3	18	10	6	R.	R.	Turk, male, 21.
										16	15	3	20	5	5			
C	78	179	144	.80	127	134	126	119	117	11	15	5	21	9	—2	R?	L?	Servian, female 18.
										16	20	5	22	7	1			
C	84	176	142	.80	128	135	128	125	119	12	8	6	20	6	—1	Eq.	Eq.	Hannan, male, 25.
										7	13	6	15	6	1			
C	94	172	139	.80	131	129	129	123	120	11	12	6	20	8	2	Eq.	R.	Bulgarian, male.
										11	13	5	20	5	0			
C	116	170	137	.80	120	133	118	113	117	10	11	1	22	4	1	L.	L.	Italian, female, 20.
										9	10	1	18	3	1			
C	138	180	144	.80	123	139	113	112	117	5	10	5	10	9	—8	Eq.	Eq.	Styrian, male, 48.
										11	13	5	18	10	—6			

C	306	165	133	.80	135	128	113	110	113	12	11	6	21	7	5	L.	L.	Mound-builder, adult.
										12	15	7	19	7	5			
C	313	167	135	80	135	131	117	114	121	11	11	4	20	2	−3	L.	L.	Do.
										11	12	3	18	2	3			
C	327	172	139	.80	137	137	121	117	115	12	14	5	20	2	4	L?	L.	Do.
										10	11	5	20	2	4			
C	408	181	146	.80	131	134	130	125	117	15	15	6	26	5	5	R.	R.	Adult.
										16	16	6	26	3	4			
C	412	170	136	.80	127	133	123	118	120	10	10	3	10	5	5	L.	L.	Young adult, female.
										15	15	6	20	2	3			
C	415	182	147	.80	130	142	125	122	114	15	15	6	28	5	6	R?	R?	Adult, male.
										16	15	11	28	6	7			
C	3,113	175	141	.80	143	141	131	125	114	15	15	10	23	6	6	R.	R.	Mound-builder, aged.
										15	16	10	26	6	6			
N	1,535	177	145	.81	138	136	125	123	116	6	7	4	21	4	0	R.	R.	Finlander, adult.
										15	15	8	21	4	0			
N	1,544	179	146	.81	133	137	126	120	110	15	15	6	29	7	5	R.	R.	Do.
										15	15	8	25	4	4			
A	1,332	184	150	.81	127	143	130	124	116	16	16	12	18	10	3	Eq.	Eq.	Californian Indian.
										14	14	10	20	7	0			
A	1,964	187	152	.81	140	138	125	124	117	11	13	6	20	7	3	Eq.	R?	Austrian, male, 5p.
										12	14	5	18	6	4			
A	795	177	145	81	131	136	137	130	116	14	14	9	19	2	−9	R.	R.	Ponka Indian, 40.
										17	15	10	20	2	7			
C	1	183	150	.81	130	138	139	129	118	16	16	6	22	6	0	L?	R.	Bohemian, male, 19.
										16	15	10	20	8	3			
C	4	175	142	.81	127	141	115	111	109	9	12	4	15	6	0	R.	R.	Bohemian, male, 15.
										10	15	3	16	7	1			
C	20	179	146	.81	148	139	122	114	120	14	13	3	19	9	1	L.	L.	Ruthene, male, 62.
										15	15	4	12	9	−1			
C	28	176	144	.81	135	143	129	121	114	10	10	7	13	9	2	L.	L.	Kusad.
										13	12	5	20	8	2			
C	33	160	146	.81	128	141	132	122	121	14	15	10	24	9	4	R.	R.	Russian, male.
										14	15	12	21	10	4			
C	39	176	144	.81	141	143	119	118	110	6	10	3	12	6	2	R.	R.	Siamese, male.
										6	9	0.5	14	6	2			
C	48	179	146	.81	127	143	122	114	109	10	12	7	15	6	2	R.	R.	Italian, male, adult.
										9	10	8	12	7	−4			
C	50	181	147	.81	129	142	125	117	111	9	10	8	18	8	3	L.	L.	Japanese.
										11	10	5	18	7	1			
C	73	186	152	.81	133	145	130	123	122	16	11	6	16	6	−2	R.	R.	Russian, male, 38.
										10	11	5	16	6	3			
C	87	170	139	.81	130	138	113	109	105	11	14	6	18	9	−2	L.	L.	Carniolan, male, 19.
										8	13	4	18	6	0			
C	90	183	149	81	128	147	134	131	129	16	15	10	15	8	3	R.	R.	Servian, 24.
										15	16	12	16	8	3			
C	92	180	147	.81	138	144	131	125	118	10	14	5	17	8	3	L.	L.	Bosnian.
										15	12	10	16	5	1			
C	103	179	146	.81	130	140	122	116	121	8	14	5	18	6	0	Eq.	Eq.	Roumanian, 21.
										7	16	3	16	6	2			
C	106	186	151	.81	131	145	133	128	113	15	17	12	19	6	5	Eq.	Eq.	Austrian, 22.
										15	15	10	17	5	5			

Detailed data of measurements—Continued.

	Skull.	Length.	Breadth.	Index.	Height.	Parietal.	Mastoid.	Spina.	Sulcus.	Operation room.	M. S.	Thinnest point	Back.	Fossa. High.	Fossa. Lat.	Larger Sulcus.	Larger Caput.	Remarks.
C	117	171	140	.81	120	135	124	121	117	15 15	15 15	9 10	12 22	5 4	3 3	R.	R.	Maltese, male, 40.
C	118	177	145	.81	138	145	120	115	116	9 9	15 15	11 12	10 10	5 4	2 3	R.	R.	Italian, male, 30.
C	354	175	143	.81	125	132	127	123	127	11 12	11 12	9 9	20 20	3 3	—1 —2	Eq.	Eq.	Irish, adult.
C	407	174	142	.81	134	133	123	120	116	17 15	16 16	10 6	21 21	7 5	2 3	L.	L.	English, adult.
C	481	190	154	.81	145	144	131	128	123	15 17	16 18	7 10	21 22	9 9	6 6	R.	R	Aged white.
C	3,001	172	140	.81	124	135	131	121	120	12 13	11 12	6 6	21 10	10 3	4 3	L.	L.	Mound-builder, adult.
C	1,008.10	186	151	.81	137	143	134	128	118	16 13	15 11	5 6	28 22	6 3	0 4	R?	L.	French, adult.
N	1,541	179	147	.82	140	139	126	120	120	11 11	12 12	4 7	21 18	5 3	3 —3	R.	R	Finlander, adult.
A	345	180	149	.82	138	130	130	131	112	16 11	16 13	11 9	21 21	8 6	6 5	L?	L.	Alaska Indian.
A	835	172	142	.82	127	136	124	121	116	7 10	7 10	4 6	22 14	4 3	—1 —1	R.	R.	Ponka Indian, male, 35.
A	1,974	175	145	.82	124	136	127	125	117	11 11	11 13	6 7	19 16	13 8	3 3	R?	R.	Bavarian, male, 75.
A	1,981	173	143	.82	129	139	118	118	107	14 14	15 16	8 8	16 16	9 7	3 0	L?	R.	Bavarian, male, 80.
U	43	172	141	.81	130	136	122	117	114	12 9	15 9	6 6	13 12	15 15	1 1	L.	L.	Peruvian, adult.
U	4,05	176	143	.81	128	129	118	113	116	5 10	10 11	5 3	5 10	3 1	—3 3	R.	R	Adult, syphilitic.
U	3,875	172	140	.81	138	131	134	129	122	14 15	15 16	10 15	22 5	7 3	4 4	R	R.	American Indian, adult.
N	4,122	170	139	.81	131	133	126	119	107	15 15	17 16	3 8	20 18	12 6	2 2	R.	R.	Mulatto, female, adult.
U	44	170	141	.82	132	139	125	119	116	16 15	15 16	10 10	15 18	10 8	1 1	R.	R.	Peruvian.
U	3,878	169	139	.82	121	128	119	120	125	10 10	10 10	5 7	20 12	7 4	0 1	R?	R	American Indian, adult.
C	3	179	147	.82	131	139	130	123	118	15 15	15 15	8 3	19 16	14 7	0 3	R.	R?	Jew, 41.
C	26	184	151	.82	135	151	128	124	106	10 15	12 15	5 11	16 12	8 9	4 3	R.	R.	Servian.
C	35	180	148	.82	131	142	126	126	122	9 10	8 10	6 4	12 10	8 10	5 5	L.	L.	Russian, adult, male.
C	41	177	146	.82	131	141	134	128	121	12 11	11 11	3 4	21 21	3 2	3 5	R.	R.	Swiss, male, 50.

C	43	180	148	.82	132	144	137	129	118	17	11	10	14	2	1	Eq.	Eq.	Italian, male, 32.
										11	10	10	14	4	0			
C	56	180	148	.82	131	147	123	121	116	9	14	4	13	9	1	L.	L.	Hyrriot, male.
										9	10	4	16	7	1			
C	120	174	143	.82	132	136	129	120	116	15	15	4	22	9	4	R.	R.	Italian, male, 20.
										15	15	2	21	9	4			
C	139	176	145	.82	134	151	130	124	125	15	12	5	21	8	4	R.	R.	Pole, male, 26.
										11	10	6	19	9	6			
C	144	177	146	.82	147	137	128	122	123	15	15	6	19	4	2	R.	R.	Aged adult.
										13	15	8	17	3	4			
C	401	168	139	.82	126	132	121	115	118	13	14	5	20	0	8	L.	L.	Aged white.
										10	11	3	16	2	−5			
C	411	178	147	.82	131	141	129	126	123	12	12	3	22	4	4	L.	R.	Young adult.
										15	15	6	20	1	2			
C	417	174	144	.82	131	140	121	116	118	13	13	6	30	6	2	Eq.	Eq.	Do.
										15	15	7	24	1	1			
C	1,008.15	181	150	.82	137	143	130	124	128	8	8	5	20	8	1	R.	R.	Female, 29.
										15	15	5	22	7	1			
C	1,169	181	149	.82	145	140	125	121	112	12	16	5	22	7	2	R.	R.	
										15	16	8	21	4	1			
C	1,169.6	170	141	.82	135	138	119	117	113	11	7	3	11	8	4	L.	L.	
										6	7	3	11	8	4			
C	1,178.1	158	130	.82	120	126	103	100	108	6	4	1	11	4	1	R?	R.	Female, 11.
										6	4	2	8	3	1			
C	1,182.7	170	140	.82	122	139	106	106	109	1	3	1	5	5	2	R?	R.	Adult, syphilitic.
										1	4	1	5	8	2			
C	3,109	160	132	.82	141	125	116	113	116	15	15	10	14	1	7	Eq.	Eq.	Mound-builder, adult
										13	14	7	14	5	4			
C	15	180	150	.83	131	144	131	125	113	17	15	6	22	11	5	R.	L.	Hungarian, male, 21.
										16	16	7	22	7	3			
C	23	183	153	.83	141	151	131	121	115	15	15	7	20	7	4	R?	Eq.	Pole, male, 51.
										14	16	10	20	10	0			
C	42	165	137	.83	115	135	122	122	116	5	5	3	12	6	−2	L.	R?	Italian, female, 23.
										8	7	5	12	3	0			
C	46	178	148	.83	127	143	128	121	123	11	16	5	20	10	−1	L?	Eq.	Sicilian, male, 28.
										10	16	6	15	10	0			
C	60	171	143	.83	129	143	110	108	108	6	11	3	12	5	1	R.	R.	Austrian, male, 16.
										8	11	3	11	2	0			
C	62	165	137	.83	144	134	117	111	112	5	7	2	20	7	−1	R.	R.	Austrian, male, 13.
										7	11	2	20	3	1			
C	67	154	129	.83	116	124	116	115	111	10	15	4	16	9	2	R.	R.	Tyrolese, male, 30.
										15	12	6	20	10	1			
C	69	173	145	.83	130	142	126	123	116	12	11	5	16	7	2	L.	L.	Hungarian, male, 40.
										10	12	6	16	5	4			
C	86	173	145	.83	132	142	130	123	107	18	15	11	21	7	4	R.	R.	Krain, female, 48.
										18	16	12	21	6	2			
C	95	174	146	.83	128	139	126	120	117	15	16	5	21	9	−2	R?	R?	Wallachian, 32.
										15	16	7	20	9	−2			
C	96	177	148	.83	133	144	123	115	117	10	15	7	21	2	−1	Eq.	R.	Roumanian, 35.
										7	10	5	16	1	−0			
C	100	177	147	.83	140	142	130	129	120	15	15	8	20	6	2	R?	R.	Russian.
										15	15	10	19	6	1			

Detailed data of measurements—Continued.

	Skull.	Length.	Breadth.	Index.	Height.	Parietal.	Mastoid.	Spina.	Sulcus.	Operation room.	M. S.	Thinnest point	Back.	Fossa. High.	Fossa. Lat.	Larger. Sulcus.	Larger. Caput.	Remarks.
C	101	177	147	.83	137	144	129	124	110	15	15	6	14	8	+1	R.	R.	Don Cossack.
										13	15	5	24	3	-2			
C	130	179	149	.83	129	144	124	122	117	12	10	6	19	8	3	R?	R.	Gypsy, male, 24.
										15	15	6	22	5	3			
C	132	178	149	.83	125	146	125	120	119	15	15	6	19	5	3	R.	R.	Dalmatian, male, 28.
										16	15	5	16	5	2			
C	142	166	138	.83	121	135	121	119	103	16	15	8	18	5	1	R?	R?	Peruvian.
										16	15	12	20	0	4			
C	410	176	147	.83	110	139	119	111	115	10	8	3	20	4	−1	R.	R.	White, 17.
										12	12	3	20	3	0			
A	2,366	168	141	.83	131	138	116	113	106	10	10	5	16	7	0	R.	R.	Austrian, female, 15.
										10	13	6	16	7	0			
U	010	177	148	.83	.....	.....	132	127	122	10	11	6	21	5	1	L.	L.	White adult.
										11	10	8	20	6	6			
U	218	193	161	.83	138	.....	114	114	117	5	7	2	10	12	0	R.	Eq.	
										4	6	2	10	14	0			
U	261	171	142	.83	.....	.....	110	109	110	11	10	6	21	7	1	L.	L.	Negro, adult.
										9	6	2	20	9	2			
U	1,134	175	146	.83	132	139	125	118	110	12	15	5	19	3	4	Eq.	Eq.	
										10	12	6	16	2	−1			
A	1,961	182	153	.84	132	146	138	123	115	11	10	8	17	9	4	R.	R.	Austrian, male, 65.
										11	10	11	17	10	0			
A	1,969	175	146	.84	130	141	123	123	117	5	7	4	11	7	0	R.	R.	Do.
										13	15	10	16	6	3			
A	1,970	179	152	.84	140	141	126	122	110	11	14	6	22	6	1	R.	R?	Austrian, male, 70.
										13	13	10	20	6	1			
A	1,972	176	148	.84	135	141	124	119	120	11	13	5	15	11	1	R.	R.	Austrian, male, 40.
										12	9	7	16	9	0			
P	D	177	149	.84	131	146	131	127	111	17	16	7	22	5	2	L.	R.	Adult.
										15	13	10	16	5	2			
C	5	171	145	.84	127	143	116	116	111	10	11	4	14	6	0	L.	L.	Moravian, male, 17.
										12	11	3	16	6	2			
C	17	174	147	.84	132	140	112	111	115	3	1	1	12	7	3	R?	R.	Croatian, male, 24.
										3	1	2	13	7	5			
C	27	180	152	.84	133	143	132	125	120	11	12	6	19	6	1	R.	R.	Roumanian
										11	12	5	19	3	0			
C	49	188	158	.84	142	157	128	120	116	9	10	7	12	3	1	R.	R.	Chinese, adult.
										11	11	7	12	6	1			
C	59	176	149	.84	136	146	127	119	121	9	11	3	18	9	4	R?	R.	Greek, male, 19.
										8	10	3	11	6	0			
C	82	176	148	.84	134	145	126	121	118	14	15	7	20	6	4	Eq.	Eq.	Greek, male, 26.
										8	15	7	21	7	−2			
C	89	166	141	.84	125	136	121	118	103	10	12	2	16	10	1	R.	R.	Adrian, 20.
										15	15	8	18	8	1			

C	107	185	157	.84	139	154	131	127	125	10	15	6	20	6	1	L.	R.	Italian, adult.
										10	15	4	18	3	1			
C	113	170	143	.84	127	139	117	114	118	11	10	2	21	3	0	R.	R.	Italian, male, 17.
										10	10	4	18	4	2			
C	121	174	147	.84	134	141	120	120	116	14	14	6	21	5	3	L?	R.	Tyrolese, male, 24.
										13	13	6	21	3	2			
C	133	166	141	.84	125	131	128	121	122	11	10	3	19	7	3	R.	R.	Italian, male, 39.
										9	7	4	16	2	2			
C	135	166	141	.84	127	141	110	107	105	6	8	4	11	4	0	L?	L	Pole, female, 20.
										10	10	5	11	3	0			
C	136	170	144	.84	130	142	123	120	117	11	11	4	19	2	3	R.	R.	Tyrolese, female, 18.
										12	11	5	14	2	3			
C	143	173	147	.84	127	146	122	120	120	8	10	3	16	9	4	R.	R.	Sandwich Islands.
										14	15	5	16	7	4			
C	309	167	141	.84	149	139	130	127	118	11	11	10	20	8	1	R.	R.	Mound-builder, adult.
										13	14	11	10	8	5			
C	416	174	147	.84	144	140	117	112	117	10	10	5	21	5	1	L.	L.	Young adult.
										10	10	3	21	1	1			
C	1,167	175	147	.84	130	137	124	120	122	15	16	7	18	7	5	L.	L.	
										15	15	6	19	6	1			
C	24	177	151	.85	123	144	126	122	115	11	15	7	12	10	—4	R.	R.	Pole, 30.
										10	13	5	14	18	—4			
C	45	180	153	.85	124	151	127	121	127	10	12	4	20	5	0	R.	Eq.	Sardinian, adult, male.
										11	10	5	20	6	0			
C	58	168	144	.85	120	140	113	110	109	3	10	1	14	7	—2	R.	R.	Armenian, female, 8.
										9	13	3	16	6	—4			
C	65	174	148	.85	140	143	127	121	120	12	11	6	12	8	—1	L.	L?	Tyrolese, male, 37.
										11	10	10	14	7	2			
C	71	172	147	.85	137	145	132	127	122	10	12	4	13	6	3	R.	R.	Kroeman, male, 35.
										11	12	5	18	3	2			
C	83	175	149	.85	132	144	131	125	119	11	15	5	19	3	1	R?	R?	Caucasian, male, 43.
										13	15	7	19	4	5			
C	97	181	155	.85	135	147	135	126	116	13	15	5	20	9	3	L.	Eq.	Albanian.
										15	15	11	20	5	1			
C	102	161	137	.85	123	129	119	114	107	15	12	6	20	5	2	Eq.	Eq.	Kasan, male, 20.
										10	15	3	20	5	2			
C	115	170	145	.85	127	141	124	121	116	11	11	2	22	6	3	R.	R.	Italian, male, 15.
										11	11	4	22	2	0			
C	119	170	145	85	135	141	130	124	112	16	16	6	26	7	4	R.	R.	Italian, male, 21.
										15	15	9	21	4	2			
C	124	180	154	.85	131	145	131	121	123	14	13	4	21	5	5	R?	R.	Caucasian, adult, male.
										15	15	4	20	5	2			
C	141	165	141	.85	137	139	130	130	117	17	16	5	21	10	4	R.	R.	Flathead Indian.
										16	15	11	21	5	5			
C	316	163	140	.85	145	138	127	122	111	12	11	5	22	5	3	Eq.	R.	Mound-builder, adult.
										10	11	6	22	4	3			
C	350	176	150	.85	145	145	125	120	119	11	15	5	23	4	1	L.	L.	Adult, male.
										15	15	5	22	2	1			
C	353	181	154	.85	146	150	137	134	128	15	14	4	21	6	1	L.	L.	Aged adult.
										14	12	5	27	1	3			
C	3,100	165	141	.85	145	136	128	124	114	15	15	7	22	5	8	L.	L.	Mound-builder, adult.
										15	15	5	22	2	8			

Detailed data of measurements—Continued.

	Skull.	Length.	Breadth.	Index.	Height.	Parietal.	Mastoid.	Spina.	Sulcus.	Operation room.	M. S.	Thinnest point	Back.	Fossa. High.	Fossa. Lat.	Larger. Sulcus.	Larger. Caput.	Remarks.
C	1,159.5	176	151	.85	140	143	133	123	116	12 11	16 15	7 8	21 20	6 6	2 2	L?	R.	Aged adult.
A	1,021	174	148	.85	134	136	137	131	126	9 9	12 11	6 6	16 18	5 4	2 3	Eq.	Eq.	Modoc Indian, male, 40.
A	1,975	181	154	.85	133	147	137	131	116	15 16	17 15	11 10	21 24	12 11	5 5	L?	L?	Bavarian, male, 35.
A	1,980	171	146	.85	135	142	122	120	122	8 8	11 11	7 6	11 11	10 5	-2 —2	R.	R.	Bavarian, male, 75.
A	1,982	175	149	.85	127	141	119	119	116	13 8	12 10	6 5	20 19	9 6	0 —3	L.	L?	Austrian, female, 55.
U	3,877	177	151	.85	138	143	131	130	120	15 15	11 10	11 5	24 30	7 4	5 2	R.	L.	American Indian, adult.
U	247	172	149	.86	140	141	123	119	111	7 14	10 15	5 6	18 22	6 4	0 2	L.	L.	Dane, 20.
U	3,887	182	157	.86	157	148	122	117	114	11 9	11 10	5 4	17 20	11 13	0 0	R.	R.	White, adult, syphilitic.
U	4,123	170	147	.86	129	136	134	130	128	15 15	11 13	10 7	20 20	5 6	2 4	R.	R.	American Indian.
N	1,252	165	142	.86	133	140	119	114	116	10 10	10 10	3 3	23 20	4 2	0 1	Eq.	Eq.	Finn, adult.
N	1,538	180	156	.86	136	156	130	125	125	11 15	10 14	4 10	16 20	5 5	0 0	R.	R.	Do.
A	1,018	170	147	.86	129	126	132	127	125	10 11	11 9	6 5	18 20	2 5	0 0	R.	R.	Modoc Indian, male, 50.
A	1,963	180	141	.86	125	132	126	121	120	8 11	9 11	7 9	18 21	5 2	2 —2	R.	R.	Austrian, male, 50.
A	1,984	165	143	.86	127	132	122	122	103	16 17	15 15	8 8	19 22	5 5	1 3	L.	L?	Austrian, female, 80.
C	11	178	135	.86	131	149	126	127	117	14 16	16 16	8 9	18 20	6 6	3 0	Eq.	Eq.	Hungarian, adult male.
C	13	172	148	.86	132	141	127	121	119	14 14	11 10	6 6	19 18	7 6	2 3	L.	L.	Hungarian, male, 28.
C	25	172	148	.86	134	141	131	127	115	15 15	15 15	7 7	16 18	9 10	1 0	R.	R.	Pole, 30.
C	29	173	150	.86	129	145	134	131	121	17 18	19 18	8 10	18 18	10 9	4 5	L?	L?	
C	63	172	149	.86	137	145	123	119	114	10 15	11 11	6 6	16 14	3 3	2 1	Eq.	Eq.	Austrian, male, 19.
C	75	176	153	.86	127	143	149	130	115	17 17	14 15	15 10	19 20	10 8	0 0	L.	L.	Wallachian, male, 50.
C	80	175	151	.86	122	147	116	114	115	10 9	10 10	5 2	16 16	9 8	3 3	Eq.	Eq.	Bohemian, male, 17.
C	109	173	149	.86	133	143	128	114	112	10 10	10 10	4 6	20 20	5 6	-2 -3	R.	R.	Italian, female, 18.

C	125	180	155	.86	135	149	124	123	113	14	16	8	21	5	2	Eq.	Eq.	Caucasian, adult male.
										15	15	8	21	5	2			
C	134	184	159	.86	132	152	119	119	117	10	10	5	17	5	0	R.	R.	Croatian, male, 21.
										6	10	5	11	8	0			
C	137	170	147	.86	132	145	126	121	116	15	15	5	20	0	1	L?	Eq.	Servian, male, 24.
										15	12	5	20	0	2			
U	0	170	148	.87	115	140	129	126	125	6	10	5	18	1	—4	L.	L.	Pole.
										4	5	2	10	3	—3			
A	1,845	161	141	.87	143	138	124	120	109	11	11	10	18	11	3	L?	R?	Aztec.
										10	11	10	17	14	5			
A	1,965	168	147	.87	130	138	123	120	117	12	14	8	18	7	2	R.	R.	Austrian, female, 45.
										15	13	9	21	6	1			
A	1,967	163	142	.87	125	132	122	118	110	10	12	8	16	6	2	R.	R.	Austrian, female, 37.
										10	13	8	18	3	3			
A	1,976	177	154	.87	141	140	126	126	111	13	10	10	16	9	—5	L?	Eq.	Bavarian, female, 70.
										13	12	8	18	9	—5			
C	66	180	158	.87	146	157	129	125	119	15	17	8	12	5	0	L.	Eq.	Tyrolese, male, 30.
										15	16	5	16	4	2			
C	93	172	150	.87	127	141	123	117	112	10	13	4	20	6	0	R.	Eq.	Bagdad boy, 13.
										15	13	6	20	7	—3			
C	129	172	150	.87	135	144	130	121	120	15	15	4	20	7	2	R?	R.	Gypsy, male, 24.
										15	15	10	20	5	0			
N	7	170	150	.88	126	137	117	113	120	11	12	6	24	3	0	R.	R.	Aged Anglo-American, female.
										11	12	6	14	4	0			
N	706	177	156	.88	134	153	129	123	124	10	10	5	20	5	—4	R.	R.	German, male, 30.
										15	15	6	23	3	—2			
A	700	168	149	.88	135	141	141	135	116	12	12	5	21	6	0	Eq.	Eq.	Nez Percé Indian, female.
										11	10	6	21	7	0			
A	995	165	146	.88	124	141	132	128	121	12	12	5	20	3	1	L?	L.	Modoc Indian, female, 45.
										11	18	10	14	2	1			
A	1,973	164	145	.88	124	131	122	121	116	12	12	6	19	8	—1	R.	R.	Bavarian, female, 60.
										11	10	7	19	8	2			
C	7	170	150	.88	135	146	128	125	116	11	12	5	12	6	2	R?	R?	Swiss cretin.
										11	12	5	12	8	0			
C	64	166	147	.88	133	145	126	117	115	12	15	4	20	12	2	R.	R.	Cretin, male, 17.
										15	16	8	12	10	4			
C	74	165	146	.88	129	145	118	112	120	15	11	4	14	3	2	R.	R.	Carpathian, male, 15.
										12	12	4	16	6	1			
C	310	169	149	.88	.....	143	134	122	117	16	16	12	22	8	2	R?	R.	Mound-builder, adult.
										15	15	11	24	7	6			
U	4,163	163	146	.89	125	141	124	123	116	10	13	8	19	3	4	L.	L.	Adult, female.
										10	11	5	19	3	2			
A	1,977	160	143	.89	132	137	122	120	109	10	16	6	19	3	0	R.	R.	Bavarian, male, 25.
										15	15	12	18	3	—1			
C	8	167	149	.89	129	141	121	119	115	14	12	7	15	8	1	R?	R.	Italian, male, 48.
										10	10	8	11	9	1			
C	79	171	153	.89	127	148	130	130	126	8	10	5	11	6	1	R?	R.	Bohemian, male, 25.
										10	10	6	11	3	0			
C	88	163	146	.89	129	143	124	119	112	10	12	5	14	11	3	R?	R.	Dalmatian, female.
										14	15	7	18	8	2			
C	308	168	150	.89	145	145	130	125	124	15	15	5	22	10	5	R.	R.	Mound-builder, adult.
										16	16	6	22	7	7			

Detailed data of measurements—Continued.

	Skull.	Length.	Breadth.	Index.	Height.	Parietal.	Mastoid.	Spina.	Sulcus.	Operation room.	M. S.	Thinnest point	Back.	Fossa. High.	Fossa. Lat.	Larger. Sulcus.	Larger. Caput.	Remarks.
U	58	162	147	.90	136	143	127	121	112	13	13	9	12	10	5	-------	-------	American Indian.
										14	15	10	19	7	4			
U	4,160	174	168	.90	129	132	116	112	115	9	10	5	16	5	4	L.	L.	Young adult.
										9	10	3	16	6	2			
A	1,983	174	158	.90	124	141	133	133	130	15	16	7	21	6	2	L?	L.	Austrian, female, 65.
										15	15	7	21	7	3			
C	16	163	149	.91	132	145	128	122	112	10	11	5	12	6	7	L?	R.	Savarnian, male, 34.
										15	13	10	14	6	5			
C	77	164	150	.91	129	142	123	120	117	12	15	8	16	10	1	R.	R.	Croatian, male, 24.
										15	16	10	20	7	0			
C	3,108	163	149	.91	147	137	124	120	120	15	18	11	21	6	4	R.	R.	Mound-builder, adult.
										15	15	10	21	6	4			
N	98	157	146	.92	129	144	127	122	110	15	15	5	30	6	2	L.	L?	Anglo-American.
										13	12	6	21	6	0			
N	724	149	138	.92	140	132	110	109	113	8	10	4	16	4	0	L.	L.	Anglo-American, female.
										.2	4	.2	5	6	1			
U	07	150	138	.92	124	131	119	116	112	15	14	11	22	8	1	L.	L.	Esquimo.
										12	15	10	20	7	2			
C	6	170	157	.92	137	148	125	122	119	11	7	9	11	9	—3	L.	Eq.	Swiss cretin.
										11	10	6	11	10	—2			
C	3,099	170	157	.92	150	147	138	130	117	15	16	15	18	2	—1	Eq.	Eq.	Mound-builder, adult.
										15	15	15	5	4	—2			
C	3,102	165	153	.92	146	147	133	131	125	12	15	6	23	6	0	R.	R.	Mound-builder, old.
										15	15	10	23	1	2			
A	1,019	166	153	.92	131	142	137	130	125	11	12	5	21	10	2	L.	R.	Modoc Indian, male, 40.
										13	15	5	22	8	1			
A	1,999	150	139	.92	133	134	120	118	100	13	14	10	22	8	4	L.	L?	Aztec, female, 75.
										11	13	10	15	6	1			
A	61	166	156	.93	131	146	134	127	120	12	15	13	13	6	2	L?	R.	White adult.
										15	15	11	13	5	—1			
C	114	158	151	.95	128	145	127	126	120	13	15	3	24	5	1	R?	R.	Italian, male, 24.
										11	15	5	24	5	0			
N	1,704	158	133	.96	124	152	123	117	122	10	10	6	20	7	4	Eq.	Eq.	Peruvian, aged.
										12	12	6	23	5	3			
C	319	154	150	.97	.....	148	125	122	118	10	10	5	22	4	3	R.	R.	Mound-builder, adult.
										10	10	4	22	2	3			

SECTION XV.—DERMATOLOGY AND SYPHILOGRAPHY.

Honorary Presidents.

Dr. Silva Aranjo, Rio de Janeiro, United States of Brazil.
Dr. L. Duncan Bulkley, New York, N. Y.
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Dr. Prince A. Morrow, New York, N. Y.
Dr. R. B. Morison, Baltimore, Md.
Dr. D. W. Montgomery, San Francisco, Cal.
Dr. A. Ravogli, Cincinnati, Ohio.
Dr. A. R. Robinson, New York, N. Y.
Dr. Antonio Rubio, Pinar del Rio, Cuba.
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Dr. Adolfo Briceño Picón, Merida, Venezuela.

ADDRESS BY THE PRESIDENT OF THE SECTION, DR. A. H. OHMANN-DUMESNIL.

AMERICAN DERMATOLOGY.

GENTLEMEN: I have the honor, not to mention the pleasure, of bidding you welcome to the deliberations of the section on dermatology and syphilography of the Pan-American Medical Congress. We are assembled here as representatives of American dermatology and we will be judged by our works. It may perhaps seem strange that I speak of American dermatology. Yet the day has come when we are to be emancipated from the thralldom of the Old World, which has for so long bound us in its fetters. It is within the memory of almost everyone present when if any fact or observation did not emanate from Europe it was treated as either worthless or not deserving of attention. The Western Hemisphere was dependent upon the suffrage of Europe, and as a result nothing but European ideas dominated us. It took many years of earnest work and independent thought to establish the position which is slowly gaining ascendancy among us and which destiny has decreed shall place us in the front rank of investigators.

In following the rise and development of American dermatology it will be noted that no inconsiderable weight was exercised by the French school at its beginning. Ricord in syphilis, aided by the French dermatologists, found many enthusiastic and apt pupils who returned to this country full of the precepts and enthusiasm of their teachers. There seemed to be little liking and still less demand for anything which did not emanate from Paris. In fact, the capital of France at that time was the center of arts and sciences of the civilized world, and what was beyond was "οἱ βάρβαροι" of the Greeks. And the sway thus established did not last for a few years only, but exercises its influence to this day. For, although this country has been emancipated from the yoke, to assume another one for a space of time, if I mistake not, the Latin-American countries of this hemisphere still acknowledge the supremacy of the French school.

Following this came a marked revulsion in feeling, due to the influence of Hebra and the Vienna school. Every one flocked to the school of the celebrated Austrian teacher and sat at his feet to absorb his precepts and teachings. He had the art of demonstration which carried conviction to the minds of his hearers, and he has to-day, perhaps, more disciples than any other dermatologist could ever count among his followers. In fact, he founded a school, that of Vienna, which, in spite of all the advances made, still makes struggles, far from unsuccessful, to maintain the supremacy which lay in its hands for so long a time. Its influence may be felt to-day all over the world; and, whilst it could not endure for all time, the master mind which guided it will be felt for many years to come. The acquired facts of dermatology and the practical applications to be derived therefrom were directed into new channels, which immediately became productive of new ideas and of principles of the highest value. The impetus thus given has not ceased to be fruitful and productive. On every hand we encounter pupils of the great master and reformer, and they number among the best and most prominent dermatologists of our country. In almost every work we take up we can detect evidences of the influence of the Vienna school, and it must be said in justice to it that, through this very influence, order has come out of chaos, and dermatology has assumed its proper place in the art of medicine.

Another factor which has had more than an ordinary influence on American dermatology is that due to the impetus which has been exercised by the English. Although conservative, to a fault almost, everything they have done has been executed with a conscientiousness that bordered upon the hypersensitive, and as a result we find to-day a large number of practitioners who depend wholly upon

Erasmus Wilson. This author did more, perhaps, than any other who wrote upon skin diseases to popularize the study of these affections among the English-reading portion of our medical population, and it is due to him to state that he was the pioneer who made the road easier for subsequent British writers on the same subjects, and their latter-day successes owe much of their popularity to the indefatigable worker of more than a quarter century ago.

The American is known to be the result of a combination and fusion of different peoples, and as a rule the best of the qualities of these have been retained in the product resulting therefrom. This being the case, there is no cause for surprise at the resultant being a race which is quick, perceptive, and ingenious, not to mention its inventive faculties. In addition to this, a certain independence in spirit and in lines of thought has had a far-reaching influence in bringing the American nation to the position which it occupies to-day. These qualities have been among the prime factors which have placed American dermatology on the plane which it occupies to-day.

For a long time original investigation, and in consequence original ideas, had no opportunities in which to develop. Everyone almost seemed to be satisfied with the *obiter dicta* which were sententiously announced *ex cathedra*. But that spirit of restlessness and inquiry which are the necessary accompaniments of enlarged views and higher education led to investigation, and the result is plainly indicated in the achievements which daily adorn the pages of current medical literature and which are reproduced the world over.

American dermatology has established a position for itself which, in view of the various disadvantages which it has had to overcome, as well as the preconceived ideas which had to be and still must be combated, it can well be proud of, especially when we take into consideration its achievements and the great promises for the future which it holds forth. No "pent-up Utica" is sufficient to set bounds for it. The men who are now prominent in the field are all hard workers, whose interest in their chosen study did not originate yesterday, nor will it cease to-morrow. It is ever-present and always progressive. It is destined to be more and more fruitful, and its promises for the future are most glowing. A characteristic of American dermatology, as it is of all branches of the medical art in this country, is that much more attention is paid to the clinical and therapeutical phases of a subject than to the purely pathological. Of course this does not signify that pathology has been ignored by any means, but not so much attention has been paid to it as on the Continent. Despite this, we have contributed some of the most valuable articles on diseases of the skin, in every particular, that have been included in accepted dermatological literature.

The independence of thought and originality of investigation spoken of before have had no small influence in the work of laying the foundation for what promises to be a noteworthy structure, which is destined to attract the attension of the world. I refer to a distinctively American school of dermatology. Our therapeutic methods have a tendency to simplicity, and in general we trust more to personal investigation and verification. There is a much greater impulse to determine the true etiological factors of disease, and as a result greater independence in the application of therapeutic methods. The formal utterances of authorities have but little weight with the rank and file, whose experiences in many instances have entirely changed preconceived opinions which were based upon insufficient data.

Taking all these facts into consideration, there can be no doubt that progress of a marked and practical character is taking place in America, and a large increment to the total will be the inevitable result of a gathering such as the present one.

We, and the rest of the world with us, are ignorant of the wealth of material which lies "unknown, unhonored, and unsung" in the vast recesses of the West

Indies, Sandwich Islands, and South American States, not to say Mexico and Central America. Give us all this wealth of material, for which we will gladly exchange that which lies in our hands, and the day will not be far distant when the Western Hemisphere will be enabled to boast of an American dermatology which will have arisen to the dignity of a school second to none and respected above all.

This is our beginning; and the fervent prayer of him upon whom the high honor has devolved of presiding over your deliberations is, that it will prove the end of the entering wedge which will lead to those results which the ability and progressive spirit and energy of all Americans are competent to accomplish.

PAPERS READ BEFORE THE SECTION.

THE MILIARIA GROUP.

By S. POLLITZER, A.M., M.D., of New York.

Besnier and Doyon,* in a note to their translation of Kaposi's treatise, remark that our knowledge of the sweat glands, as compared for instance with that of the sebaceous glands, is very deficient. It is not difficult to account for this fact when we consider the obstacles which the location of the chief portion of the gland, deep in the cutis, creates: that the great number and close relations of the glands make it impossible to observe clinically the beginning of a disorder in a single gland; and, finally, that the early involvement of the neighboring cutis in most cases entirely obscures the relation of the sweat gland to the pathological process. There is no reason, however, to believe that the sweat glands are favored with any special immunity from the disorders to which all glandular structures are subject. It is nearly thirty years since Hebra † wrote that up to that time no diseases of the sweat glands involving structural changes had been described, and since that time not much has been added to our knowledge. The host of young dermatologists, however, in the great medical centers, who are subjecting all the diseases of the skin, the common not less than the rare, to a rigorous microscopical study, and the improved methods of examination augur well for our progress in this special department, not less than in the whole field of dermatology.

To review for a moment the organic diseases of the sweat glands, which have already been described, it was my good fortune to be the first to establish as a disease of the sweat glands,‡ on the sure footing of pathological anatomy, a disorder which the keen eye of the great French clinician Verneuil had led him to locate in the sweat glands, and which he called, on purely clinical grounds, "hidrosadénite phlegmoneuse," and the papers of Dubreuilh have corroborated my results. At the present time there exists some confusion as to the pathological relations of adenoma of the sweat glands. Darier and Jacquet's "hydradénomes éruptifs" and "adénomes sudoripares," Török's "syringo cystadenoma," Perry's "adenoma of the sweat glands," Quinquand's "cellulome épithélial éruptif kystique," etc., describe conditions which have been referred to the sweat glands, but many of them, we know now, are independent of these structures; in fact, with the exception of two or three cases in which a true adenomatous proliferation was found disguised under other clinical conditions,§ no case of this

* I., p, 185.

† Sydenham Ed., 1866, Vol. I, p. 71.

‡ Jour. Cut. and Genit. Dis., 1892.

§ Elliot, Jour. Cut. and Gen. Dis., May, 1893.

form of tumor has been described. These benign epithelial growths of the skin are being now vigorously studied, and we may soon hope for fuller light on the subject.

It appears certain that malignant (cancerous) growths may originate in the sweat glands, and when we have added atrophy, hypertrophy, and fatty degeneration of these structures we have almost exhausted the brief register of the organic diseases of the sweat glands. There remains only the group which forms the subject of this paper.

I propose to group together three disorders of the sweat gland apparatus which depend on an obstruction to the flow of sweat through the duct. The term miliaria is now used to designate an eruption of minute vesicles or papules with clear or cloudy contents, associated with excessive sweating; and the various terms sudamina, M. crystallina, rubra, alba, vesiculosa, papulosa, and lichen tropicus have been applied to two distinct disorders, sometimes indiscriminately.

Miliaria crystallina or sudamina consists of an eruption of perfectly clear transparent vesicles from the size of a pin's head to that of a split pea, that develop anywhere on the body in the course of some general febrile disease (articular rheumatism, puerperal fever, typhoid, etc.). They have been aptly described as resembling drops of dew scattered over the surface. They are accompanied by no subjective symptoms whatever, are of brief duration, and their disappearance is followed by but slight desquamation. The eruption is entirely without diagnostic or prognostic value to the disease with which it is associated.

The anatomy of the vesicle has been studied by Haight, Robinson, and Török. They agree that the vesicle is located wholly in the horny layer of the epidermis, and that a sweat gland duct may generally be demonstrated leading into it. The vesicle depends on an obstruction to the outflow of sweat, which, unable to escape, distends the tissues below the point of obstruction. This obstruction must be located in the uppermost layers of the stratum corneum, if not in the very surface of the integument. Haight's theory of the cause of the development of this vesicle was, that in a sudden outflow of sweat the current forces one turn of the spiral duct against another, forming a valvular occlusion. This view, it seems to me, is not tenable. Such an occlusion would naturally take place at the first spiral turn in the course of the sweat current and not at the last. The vesicle would therefore be located at the bottom of the rete and not at the top of the horny layer. A more reasonable explanation, it appears to me, is that in the neglect to which the skin is necessarily subjected during the anhydrotic stage of the fever in connection with which the rash occurs, the orifices of the sweat ducts become blocked up by epidermic débris, and nutrition changes in the epidermis, due to fever, may aid in producing this effect. The fluid, when the perspiration is restored in the "critical sweat," can not pass the obstruction in the surface and distends the tissues just below the point of occlusion.

In miliaria rubra, called also lichen tropicus, miliaria vesiculosa, miliaria papulosa, miliaria alba, eczema sudamen, and prickly heat, the seat of the lesion is somewhat deeper. The affection is too well known to require more than a few words as to its clinical appearance. It consists of minute vesicles or papules on a slightly reddened skin, which itches and prickles intensely. The contents of the older vesicles are sometimes cloudy or opaque, and they have a whitish appearance; hence the term M. alba. Aside from the evidence afforded by the histological examination, the clinical appearances and the course of the disease alone negative the view of the Vienna school that M. rubra is an eczema. No eczema will remain for weeks in the erythematous-vesicular stage without weeping, and no eczema will disappear, as does prickly heat, sometimes within twenty-four hours, leaving hardly a trace. I have before me many gentlemen who come from tropical countries, and who have large experience with prickly heat. It can not be necessary to dwell on the manifest differences between an eczema and this disease.

The anatomy of miliaria rubra has been studied by Robinson, Török, and myself. Robinson regards the affection as an eczema. Török looks upon it as due to sweating, but the vesicles are not, according to him, associated with the sweat ducts. My own observations published in the Journal of Cutaneous and Genito-Urinary Diseases, February, 1893, were based on the histological study of eight cases in different stages and from patients ranging in age from the infant to the adult. I reported in that paper that I had found the vesicles to be always connected with the sweat ducts, but subsequent studies on other cases lead me to modify this statement somewhat. I agree with Török that the vesicles are sometimes the result of inflammatory colliquative changes in the epidermis, but believe this form of vesicle to be the exception and to occur only in cases attended with a great deal of irritation. The characteristic vesicles are always found in or below the stratum granulosum, but the entire sweat canal in the epidermis is distended often with fluid below this point, forming a funnel-shaped spiral canal.

Serial sections are necessary in many cases to enable the observer to determine with certainty the relation of the sweat gland to the vesicle. The contents of the vesicles—which it would be correct in some respects to call cysts—are at first perfectly clear; later they become filled with cellular elements and the spaces are sometimes occupied by a compact mass of granular elements and epithelial detritus. It is in this stage that they clinically resemble papules, though a minute vesicle deep in the epidermis will also give the appearance of a papule. Otherwise the only histological appearance to account for the clinical picture of the minute papules which have given the name of miliaria papulosa or lichen tropicus to the affection consists in a minute circumscribed thickening of the horny layer at the orifice of the sweat duct. There is in the cutis only a slight amount of perivascular infiltration, but here and there the emigration of white blood corpuscles in the papillary layer is very considerable, and it is above such patches that vesicles of colliquative origin sometimes appear. This evidence of inflammation is only natural when we consider the great strain on the papillary blood vessels and the vasomotor nerves due to the heat and the added effect of the irritation from the blocked-up sweat ducts. We have no positive data for an explanation of the blocking up of the ducts while the sweating is so active as in those who acquire prickly heat. In my publication* on this disease I have advanced a theory to account for this phenomenon. The horny layer, bathed constantly in sweat, becomes saturated with watery fluid, and the cells, swelling by imbibition, occupy more space vertically and laterally and thus spread over the orifices of the sweat ducts, occluding them at a moment when the flow of sweat is temporarily in abeyance. The next flow of sweat meets the obstruction in the horny layer and, unable to escape, distends the epidermis first of all just below the point of obstruction; that is, below the lowest layers of the horny layer, and later, as the amount of secreted fluid increases, the distention involves the entire canal in the epidermis. That such a swelling of the cells of the horny layer actually occurs, I have demonstrated in the paper referred to. The saturation with fluid may be so great and so constant that the horny layer in the neighborhood of the sweat pore assumes something of the appearance of that of a mucous membrane; its nuclei are well preserved and take nuclear stains readily. We must still, however, account for the fact that although all persons sweat in hot weather, not everybody acquires prickly heat, or, to express it in the terms of my theory of the pathology of the disease, not every horny layer imbibes the water of the perspiration and swells. To explain this difference in the behavior of different horny layers under apparently similar conditions, I have taken into account a factor which we know differs in different individuals and in different parts of the skin in the same individual; that is, the different degrees to which the skin is normally supplied

* *Loc cit.*

with fat. Horny cells impregnated with fat can not absorb water, and therefore will not swell up and occlude the sweat ducts. Natives of tropical countries have, we know, particularly well-oiled skins, and are for this reason but little subject to prickly heat, while the inhabitant of a temperate climate resident in the tropics, who, perhaps, like the Englishman in India, takes his daily bath or two, suffers intensely from this affection. No portion in the integument sweats more abundantly than the face, where prickly heat practically never occurs; the face is better supplied with fat than any other region. There is a therapeutic hint in this theory which I should like to suggest to some of my confrères from the South. It is to prevent the imbibition of water on the part of the horny layer before the disease develops in those who are subject to it by providing an abundant supply of fat by means of inunctions with some fatty body. Of course, after the disease has once developed, soothing applications, especially powders, are indicated.

Miliaria profunda is a disease which was first described by Robinson* in 1884, and which until very recently remained without a name. It is true that Jackson,* in 1887, described the disease under the name of "dysidrosis of the face," from a fancied resemblance to the disease of that name affecting the hands, described by Tilbury Fox and Hutchinson, but aside from the fact that the existence of Fox's dysidrosis as a disease of the sweat apparatus is still *sub-judice* the resemblance between our disease and Fox's is so remote that Jackson's name was generally received with great reserve. A case of the disease has been described by Rosenberg, of Berlin, and Hallopeau, of Paris. I have seen several cases, and Robinson, in a recent paper, says that he has seen perhaps forty cases in the last eight or nine years. The rash consists of nodules of a translucent boiled-sago-grain appearance, from the size of a pin's head to that of a pea, located in the face, especially around the nose, on the cheeks and forehead. It is most common in middle-aged women, though I have seen it in children and adolescents. The nodules undergo no change after they have once formed, as long as the weather remains warm, but on the approach of winter they slowly disappear, to recur again the following summer. If they be incised a drop of perfectly clear watery fluid escapes. They occasion no subjective symptoms whatever. The anatomy of the disease has been studied by Robinson and by myself. The conditions are very simple. There are no changes in the epidermis, except perhaps those due to pressure. The corium is occupied by a cyst of clear contents, whose walls consist of a double layer of epithelial cells on a basement membrane. The coil glands show no changes, except sometimes an increase in the width of their lumen. The condition is clearly one of cystic dilatation of the sweat duct, the dilatation occupying the corium, and the obstruction on which it depends must therefore lie below the epidermis. Given such an obstruction, the secreted sweat must distend the canal, through which it can not escape. With the approach of cold weather and the cessation of sweating the sweat in the cyst is absorbed and the lesion apparently disappears. On the reëstablishment of the sweating the following summer, the affected duct is again distended by the secreted fluid. Since the obstruction lies in the corium, it is not desquamated with the epidermis, and the condition is therefore permanent.

When this paper was planned the disease had received no name except that of "dysidrosis," a term to which there were manifest objections. In the last number of the Journal of Cutaneous and Genito-Urinary Diseases (August, 1893), Dr. Robinson has a paper on this disease, to which he now gives the name "hidrocystoma." The name is certainly appropriate in that it conveys a fair idea of the pathological condition. I see, however, no reason to modify my suggestion as to the name "miliaria profunda." The aim of this paper is to emphasize the fact that there is a group of diseases of the sweat glands which have as a common feature the occlusion of the duct of the gland without injury to the secreting coil.

* Jour. Cut. and Genit. Dis.

There results, therefore, in all a kind of retention cyst. In the first or superficial miliaria, M. crystallina, the obstruction is in the uppermost layer of the stratum corneum; in the second variety, M. media or rubra, the obstruction is in the lower horny layer, just above the level of the stratum granulosum: in the third, M. profunda, hidrocystoma, Robinson, the obstruction is entirely below the epidermis. To two of these conditions the name miliaria has already been given and is sanctioned by long usage. It seemed but natural, therefore, to apply this name to the third disease, and thus to include under a common name diseases which are pathologically and etiologically so closely related. There is, of course, a well-grounded objection to the multiplication of names in dermatology: but when its purpose and tendency are the simplification of our knowledge of a group of diseases it seems to me not only justifiable but a distinct advantage. On this point I should be glad to hear the views of the section.

DISCUSSION.

Dr. Duhring. The diseases cited by the reader of the paper all belong to the same group, but in classifying them it is a question whether they should not be separated, for the reason that some are non-inflammatory and others are distinctly inflammatory. If a pathological classification be adopted, which seems best at present, they should be separated, miliaria rubra, or prickly heat, being placed with the inflammations. The anatomy of the several diseases of the sweat glands has been clearly set forth by the reader, thus elucidating the exact seat of the affections referred to.

Dr. Ravogli. I would not agree exactly with the author to call miliaria any disease of the sweat glands when we see miliaria where no symptoms of inflammation are present. For instance, I have seen frequently cases of typhoid fever showing eruption of miliaria crystallina on the abdomen and on the upper part of the thighs. In these cases the vesicles of miliaria looked just like drops of water sprinkled on the skin, and it was difficult to believe that the fluid was contained in the epidermis, so clear were they. This kind of miliaria scarcely can be said to depend on any trouble of the sweat glands, and so any inflammatory symptom shows affection of that glandular apparatus. In the cases of prickly heat there is a true inflammation of the meatus of the sweat glands, and this can be considered as a form of hidrosadenitis; the meatus of the glands is surrounded by a vesicle and appears red and inflamed. In the same way we have inflammation of the sweat glands in the depth of the corium and of the skin, producing hard and painful nodules under the skin. Rasori described one of his cases which occurred after the injection of one-fifth of a grain of pilocarpine, where the patient, after the profuse perspiration, showed nodules all over the body, which, examined under the microscope, showed to be inflamed sweat glands. I disagree with Dr. Pollitzer only on account of the name, highly appreciating his scientific remarks and observations of the facts.

Dr. Pollitzer, New York. I am very glad to hear Dr. Duhring express himself so strongly in favor of a classification based on pathology. I am surprised, therefore, that my classification of this group of diseases, based as it is strictly and solely on their pathology, does not meet with his approval. I believe that Dr. Duhring's objection is directed, not toward the real point of my contention that the three diseases which I have discussed belong together, but rather toward the name "miliaria," under which I have grouped them. This name, however, is not of my creation; it is already in common use for two of these affections, M. crystallina and M. rubra, and rather than invent a new name I have applied this term to the third member of the miliaria group. When Dr. Duhring objects to the term for

hese three diseases on the ground that miliaria implies an inflammatory affec-
ion, he forgets that the name has been used for M. crystallina, a disease certainly
ot inflammatory. Surely Dr. Ravogli has misunderstood me. I should be the
ast person to confound hidrosadenitis and miliaria. Rasori's case, which was
escribed at the London International Medical Congress, 1881, presented no features
vhich require its mention in this connection. The only lesions present were
mall, deep nodules which were thought to be enlarged sweat glomeruli.

RHINOPHYMA.

By WILLIAM S. GOTTHEIL. M. D., of New York City.

Rhinophyma in its advanced stages is not common in this country, and examples
f it come but rarely to the notice of the dermatologist. It is essentially a Euro-
ean disease, being most prevalent in Germany, Hungary, France, etc., the so-called
wine countries." Here the use of water as a beverage is practically unknown, the
ght red and white wines forming the sole drink of the people. In the beer and
quor countries, such as England, North Germany, and Russia, the disease is
uch rarer. The cases seen in this country are usually in foreigners, their founda-
ions being laid abroad and their bearers transplanting to and continuing in this
ountry the habits of their native land. In the lands of its prevalence rhinophyma
njoys a multiplicity of names. The prominent and unconcealable deformity and
he very general belief in its origin in wine-bibbing have led to a number of popu-
ar nicknames. The French call it "couperose," copperas, though it is more like
he metal itself in color than the green salt. In Germany it is "kupfernase"
copper nose) and "pfundnase" (pound nose); appropriate designations both. Its
elineation forms a staple subject for the caricaturist, and its place in comic opera
s an assured one. Nevertheless, to the patient afflicted with rhinophyma the
eformity is a very tangible and unmitigated misfortune. It must be presented
strangers with his name when he is introduced; he must carry it with him on
he street and in his business; he must be the perpetual object of the commisera-
ion, open or concealed, of his friends and relatives. Unmannered people jeer at
im, and even those whom education should have taught better manners stop to
ake notice of and to marvel at his peculiar appearance. I have seen patients
riven almost to desperation and on the verge of suicide on its account.

Gamberini calls rhinophyma an elephantiasis of the nose. The phrase is a cor-
ect enough one from a descriptive point of view, but is liable to lead to confusion
vith other elephantiases, as that of the Arabs and that of the Greeks. The latter,
f course, is an elephantiasis only by mistake; the Greek writers thus designate a
alady that they knew by hearsay only. Its true name is "lepra" (leprosy).
Elephantiasis arabum, on the other hand, is a pachydermia probably of parasitic
rigin. It rarely affects the upper extremity and never the face. The term "ele-
hantiasis" should be reserved for it alone, or, better still, it should be dropped
ntirely from dermatological nomenclature. Rhinophyma is a chronic hyper-
ophy of the connective tissue of the cutis vera of the nose, the peri-nasal por-
ions of the cheeks and forehead, and the lobes of the ears. All the vascular
ructures, the arteries, veins, and capillaries, are thickened, dilated, and increased
n number. The glandular structures of the affected skin are enormously hyper-
rophied and pour a greatly increased amount of altered secretion. In a fully
eveloped case the increase of all these three elements of the organ is well marked.
he size of the hypertrophied organ varies greatly. It may be so slight as hardly
attract attention, and it may be so great as to interfere with deglutition and
ven with respiration, and to greatly discommode the patient by its weight. In a

well-developed case the nose is generally enlarged in three distinct portions or lobes, the central one representing the tip and the lateral ones the two alæ. All three may be symmetrically developed, or the central one may be far the largest and project well down over the lower lip. In some of the recorded cases the mass thus formed has been enormous; those that we see here are not permitted to become so large. The surface of the tumor may be smooth and rounded, but more often it is irregularly nodular and marked by deep depressions and furrows that partially subdivide it into a number of secondary lobules. Thus arise masses of the most varied and irregular shapes, long-pointed excrescences, pear-shaped pedunculated lobes, and broad flat tumors. The vascular dilatation and hypertrophy are largely capillary, and cause a diffuse discoloration that varies in hue from a reddish pink to a deep purple. The color depends on the comparative involvement of the arterial and the venous radicles, the former causing the brighter reddish and the latter the darker bluish tones. The organ will be either hot and sensitive to the touch, or cold and more or less anæsthetic. The larger blood vessels, whose multiplication in size and number form so prominent a feature in the early stages of the malady, are not noticeable, the inevitable contraction of the new-formed connective tissues having largely obliterated them.

The changes in the glandular structures of the affected skin are usually very marked, and are of the more importance in that they largely affect the prognosis as to the success of operative procedures for the cure of the deformity. In a certain number of cases the skin of the tumor is not apparently more oily than is natural; the mouths of the sebaceous glands are of the usual size, and suppurative glandular and periglandular processes do not occur. These cases, however, are the exceptions. Most often a thick oily secretion covers the nose or accumulates as seborrhœal scales upon the surface; the mouths of the ducts of the glands are wide and patulous, sometimes enormously so. I have seen them measure two lines and more in diameter. The abundant secretion of the hypertrophied glands dries up into hard, dark-colored plugs, forming prominent objects in the topography of the surface of the tumor. To this excessive development of the sebum-secreting organs is due the tubercles and pustules that almost always stud the surface of the rhinophyma tumors. The sebum at the mouth and in the neck of the excretory duct dries up and sticks fast; the accumulating secretion dilates the gland cavity and forms a retention cyst behind the plug, and the consequent irritation causes an inflammation of the gland and the surrounding connective tissue. The more of these suppurating glandular and periglandular structures there are, the better the chance for any fresh surface of the tumor to become infected with the streptococcus and the less chance there is for a good operative result. In the very latest stage of rhinophyma, a stage rarely reached in this country, the connective tissue new growth in its contracting gradually cuts off a part of the capillary circulation as well as the larger vessels. The nose then becomes paler and paler, until finally it may become snow white. Its temperature diminishes and its sebaceous secretion becomes less abundant, until it is even below the normal amount. The volume of the tumor diminishes as cicatricial contraction goes on, and thus to a certain extent the disease in its last stages works its own cure. This desirable result only occurs after the disease has existed a great number of years.

As regards the etiology of rhinophyma, it must be noted that whilst by some it is classified as a distinct disease, it is frequently the sequel to long-continued rosacea of the ordinary type. Most cases will give us the history of having long had red or livid, cold or hot, and oily noses, and in some the periodic occurrence of acne papules and pustules has been a marked symptom of the early stages. I was formerly of the opinion that it was simply the last stage of rosacea, a stage not reached at all in the vast majority of cases; but there are undoubtedly cases

which there has been absolutely no antecedent rosacea; in which the enlarge-
ent has been the first symptom and long antedates the redness or the lividity.
y own operative case, to be recounted later, was one of this kind. The hyper-
ophy was the first and for a time the only symptom. Again, rosacea is almost
common among women as amongst men, yet rhinophyma affects the male sex
one. So far as I know not a single case has been recorded in a female. It seems
obable, then, that there are two distinct varieties of rhinophyma, undistinguish-
le by us as yet. One is the sequel to or the third stage of rosacea. Though
tremely rare in comparison with the frequency of the latter disease, it includes
far the greatest number of the cases of rhinophyma that we meet with. The
her is a connective tissue overgrowth from the beginning, to which the gland-
ar and vascular phenomena are purely secondary. The causes of the first
riety of the disease are of course those of rosacea, continued through long
riods of time. We may leave out of account the rosacea of early womanhood
gravated at the menstrual epoch, and that not uncommon at the menopause,
nce women do not have rhinophyma. All observers agree that the habitual use
liquors containing alcohol is the active and efficient agent in the vast majority
cases. Perhaps we would be more exact if we ascribed it to the chronic
stritis, the anæmia, and the nervous debility that the use of alcohol induces.
e various alcoholic beverages, however, vary greatly in their tendency to pro-
ce the disease in question. Beer is much less hurtful than wine and spirituous
uors, and some wines are worse than others in their effects. Hebra thought
at the Austrian and the Rhenish wines, which are poor in alcohol, but contain
rtaric acid and the ethereal oils in abundance, were more liable to produce it
an the fiery and spirituous wines of Hungary and Spain. He claimed to be able
distinguish between the vivid red rhinophyma of the wine drinker, the cya-
tic one of the indulger in beer, and the dark blue and smooth excrescence of the
andy drinker. Be that as it may, alcoholic excess and its consequences remain
e chief efficient cause of the malady. But it is not the only one. Exposure to
e weather, as in cab drivers and others, to heat, as in the case of cooks and fire-
en, must be credited with a certain number of cases. Even cold-water cures,
long continued, have been blamed for some cases. There remain others,
wever, and a considerable number of them, in which the etiology is absolutely
the obscure. No satisfactory cause for the hypertrophy can be found.

The pathology of the affection is not fully elucidated. All authorities agree in
e presence of increased connective tissue in the corium, with dilated vessels and
stended and hypertrophied sebaceous glands. Biesiadecki found a large increase
the number of blood vessels, both of the superficial layer and those going to
e corium. Bulkley found in the softer parts of the tumor a more or less
undant cellular infiltration, the denser portions consisting of closely interwoven
nnective tissue fibers. The papillæ were gone, the stratum corneum was
inned, the arteries and the veins were enlarged and dilated. Contrary to all other
servers, he found the sebaceous glands only moderately enlarged. Degenerative
anges of the sebaceous glands and retention cysts from plugging of their ducts
re found in most cases. Ohmann-Dumesnil, in a recent work on the subject,
s laid especial stress on these latter. He found the cysts to be filled with cheesy
and detritus, the specific characters of the sebaceous glands having almost
tirely disappeared. He mentions one cyst of half an inch in diameter. The
ndition of the lymphatics has not been especially investigated. This is to be
plored, since the disease presents certain striking resemblances to elephantiasis
abum or bucnemia tropica, a malady in which remarkable changes in these
uctures have been observed.

The diagnosis of this condition can present but little difficulty. It carries its
me upon its face. Carcinoma and rhinoscleroma are the only two affections

which are liable to be mistaken for it, and in the former the ulceration and in the latter the characteristic microörganism should suffice to prevent all mistakes. The prognosis should be a guarded one. The remedy to be used is a varying one, but its successful application is often very difficult. Especially should we be cautious in promising results when the process is extensive, involving the skin at the root of the nose, the forehead, and the cheeks. Unless we have resort to very extensive rhinoplastic operations our work must be done almost entirely in diseased tissue and the result must be uncertain. It is to record and to emphasize these very points that the subjoined history of a case only partly successful is given.

Treatment is simple, and presents no points for divergence of opinion. Ablation, either simple or with the formation of a flap from adjacent parts to fill up the operative defect, is the only remedy. All other treatment, remedial or palliative, local or general, is entirely useless.

Theobald M., aged 60, Alsatian, resident thirty years in United States. July 2, 1892: Patient first noticed a swelling of the nose some two years ago. He is quite positive, and his assertion is borne out by his family, that there was no enlargement of the organ before that time and that he never had a red or inflamed nose in his life. A very gradual colorless enlargement began to be noticeable in 1890. The progressive increase continued in 1891, and the organ began to get red. Scabs began to appear on its surface and annoyed him very much. He is perpetually picking them off and irritating the skin. The increase in size and redness is still going on. There has been no medical treatment. The patient is a man of absolutely steady habits. He has never been a drinker, a single glass of ordinaire and water to his dinner being the only wine he consumes. He never drinks beer, and has not touched a drop of liquor for years. Being a shopkeeper, his occupation is an indoor one, and he is in no way exposed to the elements or to the heat of a fire.

Status præsens.—The patient is a perfectly healthy man and well preserved for his age. His internal organs are normal. His skin is coarse on face and neck. The entire nose is swollen and increased in size. Its color is a reddish purple, and the discoloration extends on to the central portion of the forehead, the adjacent parts of both cheeks, and the upper lip. The skin of all these parts is bulbous and ragged, but the main enlargement affects the tip and alæ of the nose. The mouths of the sebaceous glands are enormously dilated, forming great pits, some of which are as large as French peas. Large amounts of sebum can be expressed from the glands communicating with them, and the patient is in the habit of daily squeezing them out. The expressed material is whiter than the normal secretion of the glands, and apparently differs from it in constitution. When allowed to remain *in situ* in the dilated duct of the gland this sebum dries into the scabs that give him much annoyance. In spite of the general redness of the affected skin there are few visible vessels. A number of inflammatory papules and pustules are present, together with a great number of large black comedones. The columella is affected, but the interior of the nostrils is apparently perfectly healthy. An important point is that the lobes of both ears are enlarged and livid and evidently participate in the diseased condition. The nose measures 5¼ inches around the projecting bulb. The overhanging mass interferes with respiration, especially when any catarrhal condition of the nasal mucous membrane is present. The tumor is greasy and cold to the touch. His psychic condition is a lamentable one. Residing and doing business in a far eastern district of the town, he is continually exposed to the remarks and the insults of those who see his deformity. He has the Gallic hastiness of temper, and though generally a mild-mannered man, has several times been in trouble on account of attacks that he has made upon persons whom he thought were ridiculing him. His family live in constant fear of an outbreak. For several months past he has not ventured out of the house, and he has made those around him miserable by his deepening despondency and constantly recurring threats of suicide. As I was on the point of going away for the summer when I first saw him, he was put upon indifferent treatment for several weeks. Among other things he took for some time large doses of arsenic. Of course it had no effect upon his disease.

On September 3 I operated upon him. The entire pendulous central lobe was ablated and removed down to the cartilages. The incision was a broad, elliptical one extending to the anterior margin of the alæ on both sides and to the middle third of the nasal bones and the columella above and below Then the skin of

he alæ was dissected off in a moderately thin layer as far as the naso-buccal fold n either side, and the connective tissue removed almost to the cartilages below. The skin flaps were then carefully trimmed and the edges united in the middle ine by 8 catgut sutures. As far as could be judged at the time the result was a ood one. The entire central lobe had been removed; the very large and spread-ng alæ were greatly reduced in size, the line of incision was central, and the laps were large and sufficient. The operation lasted some two hours, and its echnique was beset with considerable difficulty. The hæmorrhage was enor-nous for so small an operation. The number of arteries to be twisted was very reat, and many of them in the depths of the lateral flaps very hard to reach. It vas impossible to prevent the blood running into the anterior nares and the nouth, and several times work had to be stopped to prevent the patient choking vith blood. Two very small rolls of finger bandage were then placed on either ide of the alæ to support the lax side flaps and the whole covered with a moist ntiseptic dressing. On the third day discharge began to appear under the edge f the dressing, and it was removed. The state of things then found was not sat-sfactory. The flaps were swollen and every sebaceous gland in them was pour-ng out a purulent secretion. There was suppuration in the track of each suture, nd the uppermost one had already come away. During the next three days all he other sutures ulcerated their way out, the entire wound opened up, and all ope of primary union of any part of the operative field was at an end. The ttempt to obtain closure of the wound was most tedious and disappointing. It ook from the 17th of September, 1892, to the 20th of March, 1893, some seven nonths, to accomplish it. The alar flaps preserved their vitality and healed up n two or three weeks; but the central pieces covering the dorsum of the nose simply nelted away, leaving a defect three-fourths of an inch in breadth and 1½ inches ong. At the bottom of this defect the exposed cartilages were for a long time visible. All attempts at granulation seemed to stop; the entire wound became glazed over, nd the secretion from it almost ceased. It is needless for me to recount the many neasures that I took in the long-continued attempt to stimulate the wound to ranulate up. Months passed, and hardly any progress toward filling up was nade. The sebaceous glands continued to pour out a puriform fluid; minute sup-urative foci continually appeared, and more than once I was on the point of bsolute discouragement. Finally, under such vigorous measures as thorough craping twice a week with the sharp curette, followed by the application of pure arbolic acid and a creosote dressing, the wound finally healed.

The result, from a cosmetic point of view, has been only moderately successful. The projecting central lobe has indeed been removed, and the wide-spreading alæ ave been much reduced in size. But a depressed scar one-fourth of an inch in readth and more than an inch long occupies the dorsum of the nose. And, unfor-unately, the malady of the skin that first caused the deformity has been progres-ive. The alæ have commenced to hypertrophy again, and the rhinophyma has ncreased on the cheeks, the root of the nose, and the lobes of the ears. At best he operation has been but a partial success, and that at the expense of many nonths of pain and effort. The effect upon the patient's morale has, however, een good. Relieved of the tumor that hung at the end of his nose his hypochon-riasis has disappeared; he goes out among men again, and has regained his nat-ral cheerfulness. Still, I should hesitate to claim that his appearance has been nuch improved by the operation.

I fail to find, either in the text-books or in the recorded accounts of such cases, ny reference to any difficulties or sources of failure in these rhinophyma opera-ions. In every case a simple statement that ablation or enucleation was done, r will suffice to cure the malady, is all that is said. Of course, the reason for ny own partial failure is patent. I was dealing with and operating in diseased issue. The flaps themselves necessarily contained foci of suppuration and patho-enic microörganisms. It was out of the question to attempt to remove all the iseased skin; to have done so would have been to remove the integument of the ntire nose, of half the area of the cheeks, and of a portion of the forehead. It is ot surprising that healing, either primary or secondary, failed under such cir-umstances. But it is hard to understand why the injured tissues should have ecome so sluggish and should have so persistently refused to granulate.

I should not operate in another similar case save by a formal rhinoplasty. I should remove as much as I could of the diseased skin as well as the tumor, and take a sufficiently large flap from the forehead, or two flaps from the cheeks, in order to fill the defect. Or again, I might attempt the covering of the nose by a flap derived from the arm. But the attempt to obtain a satisfactory result by using the diseased skin for flaps is, in my estimation, useless. In the cases that have been successfully done in this way the involvement of and change in the glandular structures of the skin must have been much less profound than in mine.

A CASE OF RHINOPHYMA.

By Dr. A. H. OHMANN-DUMESNIL, of St. Louis, Mo.

Rhinophyma is by no means a rare condition, and from this fact it would be safe to assume that its successful treatment should be clearly and definitely laid down. Yet the records do not seem to justify such a conclusion. When you take into consideration the total number of cases and those which are operated upon, the percentage of the latter is not so large as we would be led to expect. Furthermore, those who do operate seem to have either no desire to report their results or have a reluctance on account of the imperfect condition which follows; so that, taken altogether, literature is far from teeming with such reports. This is one of the reasons why I have ventured to give a brief account of a case in which the final outcome was such as to make it worthy of a recital.

In general it may be premised that the *fons et origo* of rhinophyma, acne rosacea, is by no means the easy disease to cure which we are led to believe were we to be guided by the generalizations of those who have written text-books upon dermatology. We find cases which are of the most stubborn character and characterized by a chronicity which is disheartening to the patient and physician alike. When we have added to this the aggravation produced by the indulgence in alcoholics, we have a still more complicated state of affairs. The patient, despairing of ever getting well and clinging to his alcoholic habits, will in a certain length of time find that he has acquired that peculiar hypertrophy of the cutaneous structures of his nose which is known as rhinophyma, the pfundnase of the Germans, the degree of deformity differing widely in different cases, but being of such a marked character as to attract the attention of everyone.

The tendency which exists to the formation of dense fibrous tissue does not seem to be uniform. In some it ceases after a certain length of time, and a sudden standstill takes place. In others it continues to grow, slowly, it is true, until a deformity supervenes which is truly appalling in its dimensions, the pendulous nose, with its rugous, shining, red surface, gaping orifices and lobules which have been so graphically represented. I have never seen this state of affairs except in men, and these were past middle life and known as "stiff" drinkers, upon whom the condition had crept unperceived, so gradual was the process in its evolution. A peculiarity I have also noticed is that they are generally averse to any form of treatment.

I will not attempt to give a description of rhinophyma, for its characteristics are so well known to dermatologists that it would certainly appear as a work of supererogation. There is but one point to which I desire to draw attention, which is that, in general, we may divide the trouble into two varieties, viz., that in which we find one general hypertrophic mass, and that in which there are distinct lobes formed which are comparatively widely separated and markedly distinct. This difference has some little importance as bearing upon the treatment, and possibly also upon the pathological evolution of the mass. Not only this, but it may pos-

Fig. 1.—RHINOPHYMA.

Fig. 2.—RHINOPHYMA.

sibly have a further bearing upon the histological findings in the different forms, and there is a possibility of opening up a new field of investigation for pathologists, as I will endeavor to point out as I get further along in this paper. The entire subject is one replete with interest to the practicing dermatologist and offers an interesting field for more extended observation and study, not to mention more improved methods of treatment for the purpose of attaining final results of a successful nature.

The case which I am about to describe is one which possesses certain features of interest, both from a clinical and a pathological point of view. Moreover, the result of the surgical measures adopted is such as to prove encouraging in the treatment of future cases. So far as the pathological condition observed is concerned, it is one which has hitherto not been published, so far as I have been able to determine, and it is one of more than passing interest in regard to the processes which occur in the integument, for the anatomical groundwork of the skin itself is a *sine qua non* of the changes which are observed. Without any further preliminary remarks I will proceed to relate the salient features of the case, as well as to outline the principal steps of the operation which proved so successful in its final result:

Case 1.—Mr. X., about 72 years of age at the time he sought relief for his trouble (1890), was of a robust constitution and had always enjoyed the best of health. He had been in the habit of indulging in alcoholics, this being in a large measure due to his occupation, which was that of a saloon keeper. This indulgence occasioned an acne rosacea, to which he paid but little attention, as all those similarly affected are prone to do. He first noticed an enlargement of his nose in 1884, but did not pay much attention to this, regarding it as a very trivial matter. This enlargement, however, progressed slowly but steadily, and he was finally forced to seek relief, not on account of its appearance, but rather for the inconvenience occasioned, which is one that, to my knowledge, has not been mentioned heretofore by any author. The hypertrophy was of such a character, and so much tissue was developed in consequence of it, that its mass became a positive weight and pressed perceptibly upon the nostrils, forcing all the breathing to be made by the mouth, a condition which was but uncomfortable at first, but finally became intolerable.

When the patient was first seen he presented the following appearance: His general condition was that of good health, with a tendency to be stout. His complexion was florid and hair gray, a sparse beard occupying the lower part of his face. He had a look as of one who has lost sleep and is worried. In fact, his countenance did not express that ease which one would expect to observe in an individual of his build and in his social condition and circumstances. His nose was enormously hypertrophied, constituting a veritable tumor. The mass consisted of three principal lobes, well defined from each other, as shown in Fig. 1. There were two lateral lobes and one central, attached at their bases by what appeared to be rather long and narrow pedicles. Each lateral mass was pear-shaped and the central one had much the appearance of an inverted pyramid. Taken altogether, the entire growth would make a large handful and the entire weight was very nearly 2 pounds. The surface of the integument appeared coarse and irregular, the skin being notably thickened and the openings of the sebaceous ducts patulous. To the touch the mass felt hard and to a certain degree it was insensitive. The color was of a violaceous tinge, inclining to a red, and the entire surface had a shining appearance. The upper lip was completely hidden by the mass, and even the lower lip was encroached upon, rendering speech somewhat indistinct. When breathing was attempted through the nostrils it almost immediately resulted in the performance of that act through the mouth.

It is self-evident that medical treatment in such a case will never prove of any avail; the removal of the entire mass by the knife is the only course to pursue, as I will endeavor to show further on, and this course was resorted to in this case. The operation performed was about as follows: The lateral lobes of the tumor mass were removed, a small flap of the integument of each being left in order to cover the denuded surface. In each case this flap was obtained from the lower portion and was shaved thin and then turned over and up so as to bring the line of stitches at about that portion of the nose which corresponds to the sulcus of the ala. In the case of the middle lobe the same course was pursued, and of course the line of sutures was directly across the nose. The dissection of

the skin flaps was very carefully done so as to have as thin an integument as would be consistent with the proper nutrition of the parts. The stitches were fine and numerous, so as to avoid a scar as much as possible, a result which was pretty well accomplished, as may be seen in Fig. 2, representing the case after recovery. Union took place by first intention. This may have been due to the fact that after the sutures had been made the dressing which was applied consisted of iodoform collodion. A slight deformity, one, however, which would hardly be noticed, and which could hardly have been avoided under the circumstances, occurred. This consists in a very slight tilting up of the openings of the nostrils, due, no doubt, to the contraction of the tissues during the process of cicatrization. As I have stated, it amounted to but little, and merely points to the necessity of allowing for contraction of the integument as well as of scars in these cases as in all other plastic operations. At best, however, it is quite a difficult matter to estimate exactly the amount of skin required in plastic operations of this character, and in such cases as the one before us the exercise of a little economy is preferable to the exhibition of too much generosity, as any redundant tissue might be liable to take on the hypertrophic process rapidly and lead to a partial, if not a total, reproduction of the original trouble. The difference not only in the appearance of the purely physical portion of the face but in the expression indicative of the patient's morale is so evident upon comparing the two pictures representative of his state before and after treatment that comment is superfluous.

Before proceeding to a consideration of the pathology of the disease I desire to say a few words in regard to the operative measures employed. In the ordinary treatment the thermo-cautery is used for the purpose of provoking cicatricial contraction throughout the mass and thus gradually diminish the size of the tumor. This method is one which is very long; it is also very painful and it does not give a nice, even result.

Dr. Dupré speaks of the manner in which he operated upon a patient in the following words.*

The patient being under an anæsthetic, I removed from the immense tumor slices of the fleshy mass as one might slice a melon. I then sutured the raw surfaces and cauterized them with the thermo-cautery, and I made a sufficient number of incisions into the lardaceous tissue to bring the organ down to its primitive volume. The sutures were removed the fifth day. Two months after the operation we see that the mass has continued to diminish until scarcely a trace of its former condition remains.

Ollier† has practiced decortication by means of the thermo-cautery, the advantage claimed being the absence of all hæmorrhage and a comparatively rapid result. Berger‡ has a preference for the knife. He simply removes the lobes and obtains good results. Hicquet§ claims to have obtained good results by making punctate cauterizations with the galvano-cautery. Franz Wings‖ describes a method which consists in removing the entire tumor and leaving only so much as will insure a growth over the denuded portion. This growth is large and is caused by the projecting portions of the sebaceous glands, their ducts aiding in the proliferation of epithelial tissue.

Of course, these methods, which are but a moiety of those employed, are no doubt of value; but shelling out the tumor is, in my opinion, the procedure that is most likely to yield the best cosmetic results. Necessarily great caution must be observed, not only in removing all the hypertrophic tissue but also to avoid cutting away too much from the under surface of the integumentary tissue. The proper method of accomplishing this is by cutting away a sufficient quantity so as to leave the smallest sebaceous glands intact. In this manner there is much less liability of a recurrence of the disease, and a condition closely approximating the normal is retained, so far as the secretion of the glands is concerned.

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* La Clinique de Bruxelles, 1891.

† Bull. de la Société de Chirurg., March 1, 1893.

‡ Ibid.

§ Rev. Int. de Rhinolog., etc., July, 1892.

‖ Das Rhinophyma und seine Behandlung. Inaug.-Diss. Berlin, 1889.

I will not enter into a consideration of the causes of acne rosacea and rhinophyma, as it would make this paper reach an inordinate length, but will rather consider the pathology of the peculiar process spoken of, and will present some peculiarities which I had an opportunity of noting in the specimen obtained from the case which has been described above. Upon ocular examination of the excised portion it appears distinctly fibrous, its density being quite well marked. The skin proper covering this hypertrophied part is thin, being more marked in this respect in the side lobes than in the central one. The openings of the sebaceous ducts are large and patulous, more especially in the central lobe. In one lobe there appears what seems to be a large retention cyst, nearly a half inch in diameter and filled with fatty material somewhat liquefied. A number of smaller cysts of the same nature can also be made out in the same lobe, as well as in the other lateral lobe, but can not be made out in the central one. These are all clearly sebaceous cysts which were originally sebaceous glands which have become distended by the pressure exerted upon their excretory ducts. Here and there may be seen quite plainly enlarged blood vessels in cross section, and some portions of the structure seem to indicate the presence of some degenerative process. Upon attempting to cut the tumor it gives the same sensation as when a fibroid is resected. Such is a brief outline of the microscopic appearance presented.

Before detailing the microscopic findings it may be as well to give a brief summary of the descriptions furnished by a few competent authorities. Their accounts seem to differ somewhat in details and it is not unlikely that this discrepancy is due to the fact that each one was necessarily limited to a few specimens in making his observations. In the case which I have related the various appearances presented agreed pretty well with the descriptions given, so that it may be safely concluded that the microscopic anatomy, while different in minor details, is of a pretty uniform character. I propose, however, to call attention to one exceptional condition which I have failed to note in the published accounts.

Hans Hebra,* who wrote an elaborate paper on rhinophyma, including its microscopic anatomy, states that the sebaceous glands are very numerous and quite large, forming a very prominent element in the pathological condition which is present. It is his opinion that this condition of hypertrophy of the glands is secondary to the connective tissue hypertrophy, which by its development occludes and cuts off portions of sebaceous glands, which then go on secreting and thus produce a retention of sebum, which in turn acts as an irritant, and thus stimulates the tissues to further hypertrophy. Biesiadecki † also found distension of the sebaceous gland, accompanied by hypertrophy. He further noted the enlargement and new formation of blood vessels, not only in the superficial tier, but also in the branches arising from the corium. Piffard ‡ examined a case operated on by C. Wagner, and found that the horny layer of the skin was scanty, but the rete mucosum thick, with well-formed cells. The papiliæ were enlarged in length and breadth, and contained round and fusiform cells. Some sebaceous glands were normal; others were undergoing degenerative changes. The corium itself was greatly thickened and presented the appearance of formed tissue. Bulkley, § in describing a case, states that the tumor is composed of closely woven connective tissue fibres, embracing relatively large blood vessels; the rete and epidermis are unchanged, and in this specimen there appears but a single sebaceous gland, not greatly enlarged. Blood vessels consist of arteries with hypertrophied coats and dilated veins. There is more or less small-cell infiltration also seen in the tissue, together with many embryonic cells. In the figure which is given (Fig.

* Vierteljahresschrift für Dermat. und Syph., Heft 4, 1881.

† Pathologie und Therapie der Hautkrankheiten, von M. Kaposi, 1883.

‡ Archives of Clinical Surgery, Vol. 1, p. 21.

§ Acne and its Treatment, 1885.

26, p. 216, by Elliot) the papillæ have all disappeared, numerous enlarged blood vessels are shown, the rete is distinct, and the stratum corneum somewhat thinned. No sebaceous glands appear, and a small-cell infiltration is shown here and there throughout the fibrous tissue of the tumor, this tissue appearing to be one with the corium. Franz Wings* gives a very elaborate account of the microscopic investigations made by him. He finds that the epidermis undergoes no changes, nor are there any perceptible alterations to be seen in the subcutaneous connective tissue. It is in the corium that we are to find the hypertrophy. It is so great that in some places he saw the apices of the unaltered papillæ flattened by the pressure exerted by the fibrous tissues lying underneath. The number as well as the relative size of the sebaceous glands appears increased. The blood vessels are also enlarged and more numerous. The mass is composed of white fibrous tissue, with a strong infiltration of small, round cells. In many places, throughout the connective tissue, cells and nuclei could be found. He attributes the formation of the retention cysts to the constricting force exerted by the fibrous hypertrophy, which cuts off the excretory ducts from the acini and at the same time obliterates the opening by which the contents of the latter escape.

In making a microscopic examination of the parts removed in the case given I limited my sections to one lateral lobe, and found that almost each one differed from the other in some particular. All, however, agreed in some general characteristics, which I will proceed to briefly enumerate. The stratum corneum appeared normal or very slightly thinner than normal, but preserved its characteristics. The stratum mucosum also appeared normal, the papillæ being possibly slightly elongated in some specimens. The cellular structure, however, is quite marked and distinct, the pigmentary layer being remarkably prominent. The corium seems to have disappeared and merged into a mass of fibrous tissue, which extends downward for quite a distance until it is lost in the subcutaneous connective and adipose tissues. Large blood vessels are to be seen throughout the mass, and cross sections show that a distinct hypertrophy of their walls has taken place. The pigment which is marked in the columnar layer of the papillæ and also in the corium immediately surrounding them is not confined to these localities, but may be found diffused near the apices of the papillæ as well.

The sebaceous glands vary largely in numbers in different sections. In some they can not be made out at all, or are very sparsely distributed. In others again they are numerous beyond the normal, and in a few I have found them so abundant that they touched each other. In all cases in which they were found they were well filled with sebaceous material and their ducts opened freely upon the external surface of the skin. The most diligent search failed to reveal the existence of any in which the duct still existed but had been occluded. On the other hand, however, cystic bodies filled with fatty material could be distinctly made out. In each instance the characteristic morphology of the sebaceous gland had disappeared. A lining membrane of a more or less homogeneous character inclosed in a dense fibrous envelope could be seen. Some cellular débris could be made out clinging to the internal capsule of the cyst, the remains, no doubt, of the secretory cells, which continued to furnish the material which contributed to the enlargement of the cyst.

The coil glands are well developed in some parts and do not seem to have at all failed in their functions, if we are to judge from their dimensions. A peculiarity that is to be noted in connection with these organs is that the coil retains its relative position in the subcutaneous adipose and connective tissue. The strangest circumstance in connection with the whole matter is that the duct persists throughout the entire hypertrophic mass in an apparently uninterrupted and continuous tube, lined with columnar epithelial cells. This is certainly something

* *Loc. cit.*

unusual in view of the fact that the ducts of the sebaceous gland are not spared and that the pressure of the hypertrophied tissue has so thoroughly and markedly flattened the apices of some of the papillæ. The subcutaneous fat is about normal in appearance and quality, having suffered no apparent change. In the body of the fibrous mass, however, are to be seen at rare intervals, it is true, fat cells, each one of which appears to be isolated from its congeners. It was the occurrence of this strange sight that first drew my attention more particularly to a closer examination of the growth. Their appearance is strongly suggestive of a derivation from the subcutaneous adipose tissue, yet their distance from that structure is so great that we are forced to one of two conclusions. As has been mentioned, the gradual formation of the fibrous tissue of the tumor has a certain strangling effect upon structures lying in its vicinity. If these structures have a sufficient amount of resistance the slow pressure acts in the manner of a stimulus, and the result is a compensating hypertrophy. On the other hand, if not endowed with sufficient resisting power atrophy is produced, and the result becomes evident. An example of the former is seen in the hypertrophy of the blood vessels; of the latter, in the development of the retention cysts which are seen. To recur to the possible explanations which may be given for the occurrence of these isolated fat cells, we may assume that in the process of strangulation of the ducts of the sebaceous glands some of the fat cells of the sebum still contained in those ducts may have been caught in the meshes of the fibrous tissue. This would seem to be borne out by the fact that the solitary fat cells observed are smaller than those of the subcutaneous fat. Another appearance which would appear to lend weight to this view is the occurrence of irregular masses, which, while not well defined, are very suggestive of sebum, but they are very probably artefacts produced by the process of cutting sections, the knife possibly dragging some sebum over the section. This is rendered the more probable by the grumous appearance which each mass presents. The only other explanation which occurs to me is that during the progress of the hypertrophy a columna adiposa such as described by Warren* should have been immeshed in the fibers of the fibrous growth, and in that manner some fat cells might have been isolated. It is true that Warren states that we only find these fat columns where hair exists, but lanugo hairs are by no means uncommon on the nose, and well-developed hairs are frequently seen on the tip of the nose in men. This very circumstance of the connection of these columns of fat with hairs would seem to lend additional weight on account of the sparse number of those hairs and the correspondingly small number of isolated fat cells which is noted.

The question which would naturally arise is why these cells do not become absorbed through the pressure exerted upon them. This is a difficult question to answer and can only be accounted for on the supposition that some have more resisting envelopes, and their oily contents rendering them elastic they successfully oppose the pressure which is exerted.

The pathological anatomy of rhinophyma is a subject which is far from being exhausted, and, from my limited observations, I am inclined to believe that it promises to open up a large and interesting field for further and more elaborate investigations.

DISCUSSION.

Dr. Ravogli, Cincinnati. Although the essayist must be congratulated for the excellent results obtained in the referred cases, I believe, however, that in rhinophyma we can not establish a method of operating, and we have to adapt ourselves

* J. Collins Warren. Columnæ adiposæ, etc. Cambridge, 1881.

according to the features of the cases. In regard to the etiology, I would remark that rhinophyma is the last stage of acne rosacea, and although I never had to do with such an advanced case, yet I have had many cases of acne rosacea in different stages. The abuse of alcoholic liquors is without doubt an efficient cause of this disease, but yet I have found cases of this disease in ladies and gentlemen who never had tasted liquor in their lives. In these cases I found that they had suffered with dyspepsia and catarrh of the stomach, which often is the cause of the acne rosacea. Seborrhœa is the most prominent character of acne rosacea, with stasis of the blood in the vessels. I think that with a well-directed treatment of acne rosacea we can prevent the progress of the disease and the lost hypertrophic condition of the tissues, subject of the proper rhinophyma.

Dr. OHMANN-DUMESNIL, St. Louis. So far as the occurrence of rhinophyma being confined to men, it is simply a personal experience. There is certainly no doubt that it is a consequence of the process whose inception is manifested by acne rosacea. We find acne rosacea in women, it is true, as well as in men: but, in the latter, indulgence in alcoholics brings about the peculiar hypertrophy. Many other causes operate to produce acne rosacea, but so far as my experience goes alcoholic indulgence is the active factor in the production of rhinophyma. The operation which I have described and which proved so successful was one adapted to the particular case in question. No hard and fast rules can be laid down in these cases of plastic surgery, and the operative measures must certainly be governed by the peculiarity of each case.

Dr. GOTTHEIL, of New York. I believe that rhinophyma must be regarded as a hypertrophy of all the layers of the skin, but more especially of the connective tissue of the corium. The vessels also are markedly increased in number, and their walls are thickened; but the most characteristic change, next to the connective-tissue increase, is the enormous enlargement of the sebaceous glands and the dilatation of their ducts. These latter are often 2 to 3 lines in diameter at their mouths, and a soft and altered sebum continually exudes from them. Under the influence of any irritation these glands become suppurating sacs, and this renders plastic operations which look to a primary union of the parts so difficult. The case of which I show you here a moulage, and upon which is based the paper just read to this body, was by no means as extensive a one as that of Dr. Dumesnil. The operation consisted of an elliptical excision by which the entire central lobe was removed. The skin was then dissected off the enlarged alæ, masses of connective tissue and fat were removed from them, and the flaps carefully united in the middle line. Union did not occur, the sutures ulcerated out, and the entire wound became infected from the suppurating glands. A large defect was left that granulated up only with extreme difficulty. Stimulating applications of the most varied nature were used, and finally, after several months of effort, the defect closed with a broad scar. Another point that I would call attention to is the relationship of this hypertrophy of the skin of the nose to lepra Arabum. The processes are undoubtedly allied ones, and possibly identical in some cases, and it would be interesting to know the condition of the lymphatic system in rhinophyma.

Drs. Gottheil and Alfred E. Regensburger asked the reader of the paper if the disease was not an aggravated or exceptionally developed form of acne rosacea.

The reader replied that it was not.

Dr. Regensburger also asked Dr. Ohmann-Dumesnil how long since he had seen the patient after the operation, and if it was still a good result.

Dr. Ohmann-Dumesnil replied that he saw him a few weeks ago and that the result was still as perfect as the photograph, which he showed, depicted it to be.

In the discussion which followed Dr. Regensburger asked Dr. Ravogli if in his case the patient was suffering from any disturbance of the generative functions or organs.

Dr. Ravogli answered no; not as far as he was aware of.

LUPUS; ITS EXTIRPATION, AND REPORT OF CASES.

By B. MERRILL RICKETTS, M. D., of Cincinnati, Ohio.

So much has been said about this disease during the last three years by men who have spent the greater part of their time, not only in treating it, but in studying its pathology, that it might seem preposterous for one with limited advantages to offer anything new concerning it. The ravages that it produces and its persistent character have made not only the sufferer but the surgeon desperate. Considered in the light of experience it is not strange that the treatment of to-day gives but little relief. Koch has, perhaps, more nearly approached a panacea for lupus than any other investigator. Whether or not the future treatment and consequent good results are to be obtained by following up his principles is yet a question. That the disease is both local and constitutional there seems to be no doubt, and when a lesion is cured the preponderance of evidence is that it was a mistaken diagnosis; that it was not lupus, but some other disease of less virulency. However this may be, we must necessarily depend to a great degree upon the clinical history and appearance of the lesion. While we depend upon the microscopical investigation, we must not accept the picture as one to be recognized at all times. While I believe that the bacilli when found indicate a certain disease, I can not accept a statement that it is not that disease because the bacilli can not be found. In other words, I am not ready to accept the microscopical investigation as infallible. I would rather depend upon the clinical history and appearance in making a diagnosis of lupus than the statement of any microscopist. Neither do I believe in the infallibility of any diagnostician. Anything may be deceptive; just so may a person be deceived.

The rarity of the disease and the few cases which the average practitioner has the opportunity of seeing, especially outside of the larger cities, is no doubt the occasion of mistaken diagnoses. It is not supposed that a man who sees a great many cases of disease is as likely to be mistaken in his diagnosis as one who sees but few. Consequently we must rely mostly upon the statement of those with greatest experience, especially in differentiating lupus from other diseases. My experience has been somewhat limited. I have seen in public and private practice about 65 cases, but I was early convinced that treatment of any kind availed but little. This naturally led me to resort to more desperate means than was usually employed by those with whom I was associated. Scarification, curetting, cauterization in the various ways, the application of caustics, such as nitrate of silver, carbolic acid, etc., all convinced me that the disease, when possible, should be excised, or that constitutional treatment was necessary. Constitutional treatment having been found useless there was left, to my mind, nothing but total extirpation. Unfortunately the disease occurs mostly about the face, eyelids, nose, ears, and lips, places where extirpation is made with the greatest difficulty and where the greatest deformity is the result. I believe that the extirpation of lupus is about as certain, when done in its earliest stages, as some of the forms of epithelioma and sarcoma. The question arises, when does it become constitutional, and to what degree may it become constitutional when extirpation would be useless? It is also important to determine that degree in any of the malignant growths. If lupus is found upon the finger we would not hesitate to amputate that finger;

if lupus were to appear upon the hand we would naturally resort to all means of treatment to save the hand. Would it not be better to remove the hand early in the progress of the disease? We know that the removal of a finger affected with lupus has cut short the disease, and that the patient has lived for years without any recurrence. Now, if this is so, why is it not rational surgery to extirpate any lesion that may appear upon any part of the body?

The means that we now have at our command in restoring parts with both single and double pedunculated grafts should encourage both the operator and the patient in resorting to early surgical interference, no matter upon what part of the face the disease may be found. The dread of suffering, of taking an anæsthetic, and of being deformed, I might say, is the occasion of so much procrastination, not only in the treatment of lupus, but all other diseases. What are we to do with these unfortunate creatures when they present themselves to us for treatment? Are we to tell them that nothing can be done; that it is folly to attempt to relieve them? Believing as I do, that all diseased tissue should be removed when possible, I have been led to extirpate lupus on several occasions with most gratifying results. So far I have not made any classification of the disease. It is, however, necessary, in order that we may simplify matters and talk more intelligibly. I have treated the two forms of lupus (lupus vulgaris and lupus erythematosus) in the same manner.

Of the former I have seen 42 cases; of the latter 23.

Case 1.—Female, æt. 67, single, white, American, poorly nourished, posterior spinal curvature, most excellent habits. There had existed for about eighteen years a lesion upon the left cheek on a line with the lower edge of the ear. This was red, and had gradually increased in size, with here and there a tubercular nodule, giving all the characteristics of lupus vulgaris. There were also cicatrices in the surrounding tissue, showing that some of them had at various times healed and given place to more recent ones. She consulted me to see if something could not be done. My diagnosis being that of lupus vulgaris, I offered no suggestions than the total extirpation of the diseased tissue. This she readily consented to, and under the influence of cocaine, subcutaneously, I removed what I believed to be the entire amount of tissue involved. Union was primary, and she was discharged at the end of five days. Within the course of six months it was evident that the disease had not been entirely removed, and I again excised it under the influence of cocaine, with the same good result so far as healing was concerned. She was discharged at the end of six days, and we again felt that we had done all that was necessary to rid her of the annoyance. At the end of twelve months the disease again manifested itself, and I concluded to excise it as before, under the influence of cocaine, curetting the surface thoroughly and applying arsenious acid in combination with cinnabar. This was done, and an extensive sloughing was the result. It required several weeks for the wound to heal by granulation, her health in the meantime being somewhat impaired. However, by judicious management and her ability to take the requisite amount of food her recovery was uninterrupted and she was discharged at the end of eight weeks. There was no family history of tuberculosis in this case. The spinal curvature was attributed to an injury. However, I am inclined to believe that the subject was a tubercular one, without any special manifestations. She died three years after from an attack of acute gastritis, the lupus never having manifested itself again in the slightest degree.

I report this case to show the importance of persistency in the treatment, not only of epithelioma and other malignant growths, but that of lupus in any form. What the result would have been at the end of ten or fifteen years, had she lived, I am, of course, unable to say.

Case 2.—Female, æt. 70, widow, white, German: in a most excellent state of health. This patient consulted me in January, 1889, for a small lesion upon the margin of the right nasal ala, which had existed for eight years. The disease had been slow in progress, giving her no special discomfort or annoyance. It had, however, made inroads upon the wing, involving a surface about one-half of an inch along the lower margin, extending about three-eighths of an inch upward along the side of the nose. My diagnosis was lupus vulgaris, and my suggestion was its total extirpation. This was consented to, and the operation made under the in-

fluence of cocaine subcutaneously. A sliding flap was taken from the cheek and placed in the intervening space, allowing the lower margin of both remaining pieces of the ala to form the lower margin of the wing. Primary union was the result, and the patient is to-day entirely free from the disease. This has now been fifty-four months. Possibly there may yet be a recurrence, but has not the result proved that the operation was justified? There was no indication of tuberculosis in this case, nor was there any history of its having existed in her family.

Case 3.—Male, æt. 48, white, Irish, excellent health, weighing about 165 pounds, laborer, irregular and dissipated habits. He consulted me in July, 1887, for a lesion upon the left side of the nose, about midway between the inner canthus of the eye and lower margin of the ala, which had existed for eleven years. The disease had been slow in its development and there was no special discomfort or pain. It gave all the characteristics of lupus vulgaris. I advised its total extirpation, and made the operation on the following day under the influence of cocaine subcutaneously. I removed a piece of integument about 1 inch wide and 1½ inches long, cutting through the cartilage into the nasal cavity. A sliding flap was made, filling the space perfectly and resulting in primary union. This has never recurred, and I feel sure the man is as exempt from a recurrence of this disease as if it had been epithelioma. He did not give any history of tuberculosis except on the father's side, in which case the patient's own uncle died from what was considered consumption following pneumonia.

Case 4.—Female, æt. 63, single, white, American, in good health, weighing 120 pounds, consulted me in 1890 for a lesion upon the left cheek, just in front of the ear, covering a surface about 1½ inches in diameter. This answered the description of lupus erythematosus, and it was so classified. It had existed about twelve years without giving any pain or discomfort, except a burning sensation, itching, and extensive exfoliation of the cuticle. It had gradually become larger, and caused considerable anxiety on the part of the patient and her friends. Extirpation was suggested and readily consented to. This was done after thoroughly anæsthetizing the field of operation with subcutaneous injections of cocaine. The edges of the wound were coäpted with silk sutures and primary union secured.

I cut in this, as in all other cases, far beyond the line of demarcation, and removed the entire integument and cellular tissue overlying the muscular structures. There has not in this case been any return. This is the only case of lupus erythematosus in which I have been able to make the operation of extirpation, and I am quite sure that I would earnestly advise such a course, although my experience is limited to one case. True, where the disease has been allowed to progress to an extensive degree over the cheeks or about the eyelids and lips, or nose, or ears; in other words, where the disease has been allowed to extend to such a degree that extirpation would cause great deformity which could not be prevented or overcome by grafting, one must necessarily hesitate in resorting to such radical measures.

In conclusion, I wish to say that I would not hesitate to extirpate lupus tissue in any case where the parts may be restored in any way whatever. Neither would I hesitate to amputate a finger or toe upon which either one of the two forms of lupus existed. There are cases, however, where it might be unwise to extirpate the lesion. Even in cases of multiple lupus I would advise their excision if the areas affected are small. Whether this plan of treatment should be limited is a question with the operator. So far I have seen but three or four cases of multiple lupus. I am quite sure that in each case good would have resulted from the extirpation of the various lesions which either one of them possessed. Would it not be well for us to call a halt in saying that there is nothing to be done in cases of lupus? I believe that the pendulum should be swung in the opposite direction, and that the preponderance of evidence at the present time fully justifies this statement. Even though the disease should recur, it is not until quite a length of time has elapsed. I believe that the end justifies the means, and that it is humane to subject these unfortunate patients to the operation of extirpation, even though the relief be but for a short time. This, of course, requires more judgment in cases of lupus upon the various parts of the face. I have presented the subject to see if it can not be brought more prominently before the surgeons; that is, the operation of extirpation. I think the cases that I have reported and the subsequent good results from extirpation

fully substantiate what I have said. Possibly I am deceived in my diagnosis, but I am thoroughly convinced in my own mind that I am not. I do not mean to be understood as saying that the disease will not recur in either one or all of the cases; surely I could not be so foolish as to say that. I propose to extirpate lupus, if possible, wherever found. I believe that if this is done a great deal of suffering, disfiguration, and I might say loss of life will be prevented.

It would give me great pleasure if those who have been interested in this procedure would address me upon the subject. By doing this I hope to tabulate the various cases in which the operation has been resorted to.

GLYCOSURIA AS AN ADDITIONAL SYMPTOM INDICATING THE NEUROTIC ORIGIN OF DERMATITIS HERPETIFORMIS (DUHRING).

By JAMES McF. WINFIELD, M. D.,

Attending Dermatologist to the Kings County Hospital, the Long Island Hospital, O. P. D., Assistant to the Chair of Skin Disease at the Long Island College, etc.

Many cases of dermatitis herpetiformis have been reported by Elliot, Brocq, and others, pointing to some severe nervous shock as the essential etiological factor in the production of this interesting cutaneous disease. But in the writings of each no mention is made of any change in the urinary secretions. In the following cases glycosuria was present to a greater or less extent, and in all of the cases personally observed, irrespective of those herein reported, the original and recurrent attacks followed some unusual mental exertion or severe nervous shock, showing an intimate relationship between the advent of the eruption and the reception of the shock.

Case 1.—Mr. S., aged 29 years; strong and well-developed man; no history of any specific taint; habits temperate; skin dark, but perfectly healthy as to texture, etc. During a severe and prolonged mental strain (endeavoring to abort a strike at a foundry in which he was a foreman) he noticed a few painful, itchy vesicles over the neck and right ear. These rapidly multiplied until the shoulders, arms, chest walls, buttocks, and thighs were invaded. At the time of consultation the following was observed: The parts enumerated were covered with a profuse eruption of a multiform character, chronic, subacute, and acute. There were papules, vesicles, and pustules scattered throughout the entire portion affected. Frequently the three would be closely grouped together in a circumscribed patch. In parts the arrangement and distribution closely resembled herpes zoster. The vesicles were of various sizes, many of them being minutely small, while others were as large as pemphigoid bullæ. The pustules dried into dark-brown scabs.

At first the patient complained of severe burning in the diseased skin, but after the eruption had existed for two days this was accompanied with itching, which grew more intense as the process continued. The treatment was wholly palliative, bromide and chloral to quiet the nervous irritation and to produce sleep; external lotions and ointments containing antipruritics to allay the itching. All through the illness there had been polyuria. On account of this symptom, and at the suggestion of Dr. Sherwell,[1] who had seen the case in consultation, the urine was examined, with the following results: Color light; specific gravity, 1.030; nothing special by microscope; test for albumin negative. On testing for sugar it was found at all times, in varying quantities from a trace to as high as 5 per cent. With this clew the treatment was directed to the relief of the diabetic condition. Diet was regulated, mental worry removed, and the administration of codeine and the bromides, and tonics containing arsenic. The external treatment was soothing; the patient rapidly improved, and was dismissed cured in about one month from the advent of the disease. Fourteen months after he again presented himself with the same cutaneous manifestations in a less degree, which had again followed mental worry. The urine, being examined, was found to contain about 1

[1] Dr. Sherwell referred to this case at the twelfth annual meeting of the American Dermatological Association, 1888.

per cent of sugar. Beneficial results were obtained by about the same line of treatment as in the preceding attack. Since then the patient has avoided mental shock and worry and there has been no recurrence of the cutaneous disease, now nearly six years.

Case 2.—Boy, aged 13. After a severe fright, voided large quantities of urine which was found to contain traces of sugar. A short time after the reception of the nervous shock erythematous patches appeared on the neck, buttocks, and inner side of the arms and thighs. The patches became thickly studded with papules which rapidly developed into vesicles and pustules, which finally dried into dark-brown scabs. The treatment was to quiet the disturbed nerves, soothing applications to the skin lesion to subdue the intense itching, which was the most annoying symptom, antipyretics for the fever, and finally tonics. After two or three relapses the patient became fully convalescent.

Case 3.—Mrs. M., a slight but well-built woman; mother of three children; temperament nervous and hysterical; general health always good. Before the cutaneous process began she had been subjected to excessive mental anxiety and shock, superinduced by the illness and death of her youngest child. The eruption was principally over the neck, chest, and thighs, presenting the typical picture of dermatitis herpetiformis, as described by Dr. Duhring. There was no polyuria except just after the death of her child, which was probably wholly hysterical. However, the urine was found to contain sugar in small quantities. The treatment was quite similar to that of the first case, but in spite of physical improvement the mental state remained bad. The cutaneous condition would improve for a few days, followed by a relapse, successive crops of papules and vesicles appearing at short intervals. The patient was advised to seek change of scene and climate, when slow but permanent convalescence was established.

Case 4.—Mr. S., aged 40 years, of a highly nervous and excitable temperament; worries about the slightest things. Had been given to excesses in early life. The eruption, which had existed for over a year, consisted of vesicles and papules on the neck and shoulders. There was also a papulo-vesicular erythematous placque over right buttock and thigh. Frequently during the course of the disease the small vesicles would coalesce and large bullæ would be the result. There was itching at all times, being more intense during the acme of the eruption than in the beginning or the ending of the outbreak. The initial attack followed anxiety over business difficulties. The urinary secretion was greatly increased in both the first and subsequent attacks; tests for sugar always revealed it in varying amounts. When the mental disquiet subsided the urine became normal and the eruption grew less, fresh exacerbations following the slightest anxiety or worry. The patient being easily discouraged and not receiving rapid results from treatment, became dissatisfied and consulted another physician, with what results is unknown.

These cases are interesting, inasmuch as they all present a symptom (glycosuria) which has not been referred to in any article on this much-discussed disease. It is not the object of this paper to consider *in extenso* the other clinical facts, but it is proper to refer briefly to the bearing of this symptom on the theory of the disease. Since the time of Claude Bernard the existence of a sugar center in the medulla oblongata has been generally recognized. It is further known that not only after direct puncture of this center, but also in some cases of general brain shock, and in even more localized sudden lesions in distant parts of the brain, sugar in the urine has been observed. Beyond the cases of direct injury to the oblongata, there is so little uniformity in the other cases of cerebral injury that it is impossible to draw any inferences from them bearing more closely on the disease under discussion, although the presumption is admissible that in all of them there is implication of the sugar center. Whether this represents a distinct mechanical irritation, as by pressure, or whether it be produced indirectly by influences from the higher centers related to the oblongata, is more properly a neurological point. It is sufficient that the facts are established and that they offer a reasonable explanation of the glycosuria following nervous shock in the four cases reported. The occurrence of sugar in the urine, coupled with the neurotic symptoms described by other observers, corroborates the view that the cutaneous manifestations of dermatitis herpetiformis are of nervous origin

ON SOME OF THE RARER TROPHIC LESIONS IN LEPROSY.

By BEAVEN RAKE, M. D., of London,

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Leprosy is a disease in which, if the patient lives long enough, the peripheral nerves are always found to be more or less infiltrated with new growth, associated with the presence of leprosy bacilli. Though for the sake of convenience it has been customary to classify the disease into the three divisions of tuberculated, anæsthetic, and mixed, a close examination shows that this classification is purely arbitrary, for, on the one hand, a case of tuberculated leprosy in its late stages shows infiltration of the peripheral nerves with the leprous growth, thus producing the mixed form; and on the other hand, recent dissections by Gerlach[1] show that in anæsthetic leprosy the primary growth takes place in the skin around the nerve endings, extending afterwards up the branches to the main trunks. It thus appears that in both tuberculated and anæsthetic leprosy the skin is first involved, and that the question of implication of nerves is only one of degree. The nerves being thus involved sooner or later in all cases of leprosy, it would naturally be expected that various trophic lesions would follow. The more common of these, such as anæsthesia, ulceration, gangrene, and necrosis of bone, are too well known to require description; but I have thought that a short consideration of some of the rarer trophic changes may be of interest. I have used the word trophic advisedly, for though we can hardly regard the existence of trophic nerves as satisfactorily proven there can be no doubt that the changes about to be considered are dependent on disturbances of nutrition. Whether they are brought about directly by changes in special nerves supplying the tissues, or indirectly through vasomotor lesions, the point at issue is not affected, and the term "trophic" is a convenient and short one for working purposes.

The conditions which I propose to discuss to-day are: (1) Raynaud's phenomena; (2) Charcot's joint disease; (3) symmetrical bedsores; (4) perforating ulcers; (5) a condition resembling ainhum; (6) certain ophthalmic lesions; (7) zona.

(1) Raynaud's Phenomena.

In 1862 Raynaud described a condition which he called "local asphyxia and symmetrical gangrene of the extremities." He defined it as "a neurosis characterized by enormous exaggeration of the excito-motor energy of the gray parts of the spinal cord which control the vasomotor innervation." In a second thesis he maintained the following proposition: "There actually occurs in this malady spontaneous vascular spasm, inappreciable in the great vessels, but very obvious in arteries of small caliber." The symmetrical gangrene which sometimes occurs in leprosy is, as we know, associated with anæsthesia; indeed, it probably occasionally starts from slight injuries unwittingly inflicted on the anæsthetic extremities. Quite different is the condition described by Raynaud as preceding symmetrical gangrene, and called by him "arterial anæsthesia." The peculiar feature is that it is limited above by a line drawn on the same level all round the extremity. In leprosy the anæsthesia follows the distribution of certain nerves in the earlier stages, though later on it may become general. In the following case local asphyxia came on four years after the onset of the leprosy, and the two conditions went on side by side. The case has already been published[2] in full, so it will be sufficient to describe it briefly here:

Case 1.—Chevy A., aged 45, born in France, was admitted to the Leprosy Home on May 19, 1883, with anæsthetic leprosy of one year's duration. There were

[1] Untersuchungen über die Unabhängigkeit der Bildung Anasthetischer Hautflecke von der Erkrankung Zugehöriger Nerven bei der Lepra Anästhetica. Dorpat, 1890.

[2] Lancet, November 12, 1887, p. 958.

localized areas of anæsthesia on the extremities, but no contraction or ulceration. The anæsthetic skin was of exactly the same color as the unaffected skin. The disease remained practically stationary till 1886, when, on my return from Europe, I noticed a remarkable change. The following notes show the conditions October 1, 1886: The anæsthetic patches are of the usual white color; all the rest of the skin is of a dusky red. The skin thus presents the appearance of a mosaic, or of a colored map, the white patches being sharply defined against the surrounding dusky red skin. The congestion disappears under pressure. On drawing the nail across the skin, the dark color vanishes, then reappears, and afterwards a distinct bright-red wheal is observed. He says the congestion disappears when he bathes in the sea. He complains of much pain in the limbs, especially in the palms of the hands. The fingers are anæsthetic and become stiff. October 25: Gurjun liniment has failed to give relief. He says the fingers are stiffer and more painful. The left median nerve was therefore stretched under chloroform. On exposure it was found to be thickened. Some fluid was pressed from the nerve and examined, but no leprosy bacilli were found. October 29: He says there is a sleepy feeling in the palm of the hand, where there was formerly anæsthesia. When tested with the eyes shut, he refers the impact of a resistance to one side of the point actually touched. November 12: It is now raining and the color of the skin between the white patches has turned to a dusky reddish blue. He says the fingers feel cold, and that sometimes the skin is almost black during the rainy season. The temporary improvement in sensation noticed after stretching the median nerve has now entirely gone. February 14, 1887: He has been rubbing the arms with a 10 per cent solution of ichthyol in olive oil. The skin is a little light in color, but there is no change in the anæsthesia. March 14; The congestion of the skin is almost gone. He has had dysentery for the last month. April 16: He has been losing much bright blood from the bowel lately. A prolapse of the rectum was found with a congested ulcerated surface. Under chloroform the lower 2 inches were drawn down, everted, and cauterized linearly in the long axis of the bowel with a black hot wire. The mucous membrane was then rubbed over with fuming nitric acid and tannin applied. April 29: Since the operation he has passed a good deal of blood from time to time. This has been checked by enemata of nitrate of silver and of opium and by turpentine by the mouth. The violet color between the patches on the upper extremities have gone, leaving the skin of a dusky red color. From this time to his death hardly any more blood was passed, but diarrhœa was persistent. The turpentine was continued for some time, but eventually it caused retention of urine, and the bladder had to be emptied with a catheter. A trace of albumin was found in the urine. Toward the last fever came on every day at noon, and was somewhat relieved by ammonium picrate. The hands and feet became edematous. He died on May 19.

The autopsy showed 5 distinct abscesses in the liver, containing from 2 to 3 pints of pus. The liver weighed 83 ounces; the spleen weighed 18 ounces, and was hypertrophied; kidneys, 9 ounces; cortices somewhat thinned and granular; aorta very atheromatous. No recent hæmorrhage or ulceration was found in the rectum, the ulcers appearing to be cicatrized, but in the rest of the intestine were numerous sharp-cut ulcers. The median nerves were thickened, but no difference was found between that which had and that which had not been stretched. The superior cervical ganglion of the sympathetic and the ganglion of the vagus were dissected out on the right side, but no naked-eye change was observed. Under the microscope, however, numerous bacilli, both free and in cells, were found in the sympathetic ganglia and also in the median nerve.

The strange feature in this case was the appearance of the congestion between the anæsthetic patches four years after the leprosy began. Was this due to a fresh increase of bacilli in the mixed nerves, leading to invasion of the sympathetic fibers, and so to vasomotor disturbances in the sound skin? This theory seems to derive support from the discovery of bacilli in the median, which we know is a mixed nerve, and also in the superior cervical sympathetic ganglion. But the question naturally arises, Why is this condition not more frequent? for thickening associated with the presence of bacilli is common enough in the median and ulnar nerves in leprosy. I think that the involvement of the superior cervical ganglion in this case may explain the difference. The leniency of the congestion after prolonged hæmorrhage from the bowel was interesting. This may have been due to reflex contraction of cutaneous vessels set up by irritation of the ulcerated intestine, or it may have been the result of simple drain of blood from

the bowel. Be the explanation of the case what it may, the condition is unique in my experience of leprosy, and at once impressed me as presenting a remarkable resemblance to the condition described by Ravnaud. Strictly speaking, it ought not, perhaps, to be included under the head of trophic lesions, but had the patient lived longer it is quite possible that gangrene might have occurred.

2. Charcot's Joint Disease.

In two lepers I have noticed a form of arthritis reminding me forcibly of that described by Charcot as occurring in locomotor ataxia, and called by him "tabetic arthritis." The cases are as follows:

Case 2.[1]—Gopi, Hindu, aged 30, was admitted to the Leper Asylum on Septemtember 10, 1883, with anæsthetic leprosy of thirteen years duration. He was demented, and, though not dangerous to himself or others, caused considerable annoyance to the other patients from his habit of continually talking and making a noise. On February 26, 1885, the left wrist was found to be much swollen. There was effusion of fluid, and the hand was flexed toward the radial side. Grating was felt in the joint, and the carpus could be dislocated on to the anterior surface of the radius. There was no pain on manipulation. The carpal bones appeared thickened, and the fingers were shriveled and contracted. There was no history of injury, and no other joints were similarly affected. He said this condition of the wrist came on soon after the onset of the leprosy.

On May 7 a cataract of the left eye was successfully removed without chloroform or cocaine, the cornea being apparently entirely anæsthetic.

On June 2 it was noted that he walked with a jerky movement, lifting his feet high from the ground. At a late date the wrist joint became still more swollen. An incision liberated a considerable quantity of glairy pus. After this the swelling subsided, the incision healed, and the joint became much smaller than before, though still larger than normal. Unfortunately, I was absent from the colony when this patient died some years later, and so I had not an opportunity of examining the joint and spinal cord.

Case 3.—Galalal, Hindu, aged 56, was admitted to the Leper Asylum on September 19, 1888, with anæsthetic leprosy of eight years' duration. On September 21 Dr. Pedrode Montbrun amputated the right leg for gangrene. The patient made a good recovery, the stump being healed in about a month. On June 8, 1892, the left hand was found to be very edematous, and there was a brawny swelling extending up the arm. Several superficial incisions were made but no pus was found.

June 10: The swelling is less. A deep incision near the thumb liberated blood and serum. June 17: The hand is still much swollen and swelling has appeared above the wrist. More incisions were made. June 24: A fluctuating swelling above the left wrist was incised. Blood and serum escaped. July 4: The superficial swelling is less, but there is grating in the joints and much effusion. July 22: The wrist is much swollen. It was punctured, but only blood escaped. July 25: An incision liberated pus and blood. July 27: An abscess has burst on the back of the wrist. The swelling is much less. September 2: The wrist has greatly increased in size again. On incising the inner side a jet of several ounces of fœtid pus escaped. September 16: Another abscess has pointed at the inner side of the wrist. An incision released much thick pus. October 3: There is hardly any fluid in the joint, but the carpus can be dislocated. March 17, 1893: There is grating and dislocation of the wrist. The muscles of the hand are much wasted.

The points especially insisted on by Charcot as characterizing tabetic arthritis are: (1) Rapid effusion of fluid; (2) rapid destruction of the articular ends of bones; (3) absence of pain. Hutchinson doubts the nerve origin of Charcot's disease, and thinks that the changes are due to the anæsthetic condition of the joints in locomotor ataxia, which allows patients to use and move a rheumatically inflamed joint in a way in which no other inflamed joints are used. This argument of course applies *a fortiori* to anæsthetic leprosy, for the joints in this disease are often far more anæsthetic than in locomotor ataxia. In the two cases now under consideration another question arises: Were these patients the subjects of tabes in addition to leprosy? In the first subject there was certainly the jerky gait of

[1] Lancet, September 25, 1886, p. 581.

tabes, but this may have been merely due to leprous anæsthesia of the soles of the feet. In the second case the patient had but one leg, so his walking power could not be fairly tested; moreover neither of the spinal cords has been available for examination. The first patient died during my absence, and the second is still living. Clinically, both cases suggested strongly the arthritis of Charcot, for the effusion of fluid and destruction of the joint seemed too rapid for mere accident. It is true that in the second case the patient gave a confused history of a sprain while bathing, but there is so great a tendency in patients of this class to attribute every disease to some traumatic cause, that statements are naturally accepted with reserve. There are thus seen to be three possible theories as to the causation of the arthritis in these two cases: (1) That it was the result of some slight injury to anæsthetic joints; (2) that it was due to tabes dorsalis occurring in lepers; (3) that it resulted from leprous changes in the peripheral nerves supplying the joint or in the spinal cord, or in both. I think that the evidence, as far as it goes, is somewhat in favor of the last theory.

3. Symmetrical Bedsores.

In 2 cases of lepersy I have seen symmetrical bedsores in the center of the buttocks. These closely resemble those described by Charcot under the name of acute decubitus, as occurring in connection with disease of the nerve centers, but especially in cases of hemiplegia. They must of course be carefully distinguished from ordinary bedsores due to pressure and want of cleanliness.

The following are short summaries of the cases:

Case 4.—Charles Samuel, white, aged 36, born in Trinidad, was admitted to the Leper Asylum on August 11, 1859, with anæsthetic leprosy of six years' duration. Anæsthesia gradually increased until almost the whole body was involved. March 5, 1885: A large abscess on the left buttock was incised, and several drams of very fœtid pus escaped. March 24: There are two small sinuses on the right buttock discharging thin, unhealthy pus. On October 25 herniotomy was performed for strangulated right inguinal hernia. In spite of the anæsthetic condition of his tissues he made an excellent recovery, and there was a firm cicatrix in twenty-one days. He died of mixed tubal and interstitial nephritis on February 1, 1887. There was still a sore on each buttock. The sciatic nerves were normal, but the median and ulnar nerves were undergoing atrophy.

This patient had been leprous for thirty-four years when he died and for thirty-two years when the sores on the buttocks formed. It is interesting to notice that these appeared within a few days of one another. The result of the herniotomy showed that there was good recuperative power in the tissues, so that there was a probability that the bedsores were due to cerebral changes. I have never yet found leprous changes in the brains or spinal cords examined by me, though Tschiriew has found degeneration in the anterior cornua and Chassiotes says he has detected leprosy bacilli in the cord.[1]

Case 5.—N., Hindu, aged 65, was admitted to the Leper Asylum on March 17, 1893, with mixed leprosy, which she said had lasted one year, but, judging from the deformity of her fingers, it had been probably much longer. She had gangrene of the extremities and numerous ulcers on the body. She died on March 26, nine days after admission. At the autopsy symmetrical circular bedsores were found in the centers of the buttocks; the median nerves were thickened; the spleen was hypertrophied, but the rest of the viscera were normal.

In both these cases the position of the bedsores in the centers of the buttocks rendered it very unlikely that they were due to pressure.

[1] Monatsschrifte für Prakt. Dermat., Hamburg, 1887.

4. Perforating Ulcers.

I have been in some doubt as to whether perforating ulcers can be fairly included among the rarer trophic lesions of leprosy. When, however, it is remembered how rare they are in subjects who are not lepers, and also how many other lesions are more common in leprosy than these ulcers, I think they may be discussed in this paper without very much straining of a point. Perforating ulcers, as seen in leprosy, closely resemble the perforating ulcers described as occurring in locomotor ataxia, in syphilitic or other disease of the posterior tibial artery, or in peripheral neuritis. It usually begins over the ball of the great toe or over one of the metatarso-phalangal articulations. The opening is often small, and surrounded by greatly thickened epidermis, but on passing a probe the point may be felt just under the skin of the dorsum of the foot. More rarely the ulcer occurs over the heel and burrows into the calcaneum. In some of the cases there has been intense pain, contrary to the general rule. I have tried various treatments for this condition. In some cases I have incised the ulcer freely and removed any loose bone there might be; in others I have stretched the great sciatic; while in some patients I have combined nerve stretching with incision of the ulcer. In several cases healing has progressed very rapidly after stretching of the sciatic. The cavity has rapidly filled with granulations, the discharge has greatly increased and became thicker and more healthy looking, and in a few days a thin white cicatrix has begun to advance over the surface of the granulations from the edge of the ulcer. The question of course arises as to how far these changes are the result of the rest in bed which is necessitated by the stretching of a large nerve like the sciatic. The changes have, however, often seemed too rapid and vigorous to be accounted for by mere rest. The immediate relief of pain has been most marked in some cases. The sciatic has always appeared normal when exposed. Horsley's theory of a shaking of the spinal centers as a result of the stretching of the sciatic would seem to explain the changes in these cases, for sometimes after stretching a nerve on one side of the body improved sensation is noticed on both sides. The shaking of the cord can easily be shown in the dead body by cutting an opening and exposing an inch or two of the lumbar cord and then stretching the sciatic forcibly. In one case, when stretching of the sciatic gave no relief, amputation of the leg had to be resorted to, and dissection of the limb after removal showed the posterior tibial nerve to be greatly swollen, the fibers being separated by gelatinous material. It is not to be wondered at that stretching of the sciatic was ineffectual with such an interruption in the conduction lower down.

Nerve stretching, though affording temporary relief in many cases, was on the whole found to be unsatisfactory. The ulcers had a tendency to break down when the patients began to walk about again, and the pain often recurred. I therefore devised another method of treatment.[1] A bistoury is passed through the ulcer from the sole of the foot and is brought out at a corresponding point on the dorsum. All the tissues are then divided straight forward, the bistoury emerging between the toes. The incision is stuffed with lint to arrest hæmorrhage and prevent immediate closure of the wound, which is thus made to granulate from the bottom. If the ulcer should happen to be near the inner or outer side of the foot, the knife can be brought out on either of these surfaces, as the case may be. Dead bone must, of course, be taken away, if any is found in the ulcer ready for removal. I have now operated in the above way on upward of 24 perforating ulcers with considerable success. The following case may be cited as an illustrative one:

Case 6.—Sibu, Hindu, aged 42, was admitted to the Leper Asylum on March 1, 1887, with anæsthetic leprosy of five years' duration. March 18, 1889: Perforating

[1] Brit. Med. Journal, Nov. 8, 1890, p. 1059.

ulcer of right side incised and fragments of bone removed. June 15: Probe passed through to dorsum and counter opening made. July 29: Bistoury passed through and all tissues slit up forward between toes and incision stuffed with lint. August 5: Granulating well; no pain; another sinus slit up. August 16: Loose necrosed head of bone removed; granulations healthy. August 21: Incision healing well from the bottom. On May 16, 1892, diffuse suppuration in the tissues of the left forearm set in. This was followed by gangrene of the parts about the elbow and he died on May 25.

At the necropsy next day the viscera were healthy. The left forearm and arm were burrowed by abscesses up to midway between the elbow and shoulder. In the right foot was a firm linear cicatrix, where the ulcer had been incised. The cicatrix was equally firm on dorsal and plantar surfaces.

In view of the fact that perforating ulcer is associated with change in the peripheral nerves in the main trunks or in the spinal cord, it is difficult to explain the success of this operation. The ulcer certainly recurs in some cases, but a second operation, combined with removal of bone if necessary, again affords relief. In cases of repeated recurrence stretching of the sciatic may well be performed in addition to the incision. The procedure is only a modification of the well-known surgical practice of laying open a sinus and stuffing it so that it may granulate from the bottom. Hæmorrhage is easily controlled, and the only case in which I had trouble was one where the patient meddled with the dressings soon after the operation.

Dr. W. S. Barnes, writing in the British Guiana Medical Annual for 1892, says that he has adopted the treatment in the Leper Asylum there, and that he finds it safe, easy, and sure.

5. A Condition Resembling Ainhum.

One of the best descriptions of ainhum is that given by Crombie, who defines it as hypertrophy of the skin of the little toe near the digito-plantar fold, and of the tissues surrounding its middle and distal phalanges, with an attempt at spontaneous amputation at or near the first interphalangeal articulation, and in most advanced cases a conversion of the bony structures of the phalanges into fibrous tissue. Ainhum occurs only in negroes and Hindus. Nine times out of ten it is confined to one or both little toes, but in 5 out of 50 of Silva Lima's cases it occurred in the fourth toe, while Cranford has described it in the great toe, and Eyles[1] has seen it in a finger. The last observer has studied the histology of the condition, and believes that it begins as a slight wound or crack in the digito-plantar fold caused by external and accidental circumstances. The fold being deep, favors the retention of foreign bodies, such as sand or grit. The irritation of these foreign bodies if continued for any length of time would lead to hyperplasia, and the fold itself is not only favorable to furrow formation, but determines the direction of the furrow. Simple hypertrophy is followed by hyperplasia, and the papillæ are pushed down and strangled. The epithelial cells are thus removed from the blood supply and undergo horny change. Pressure on the subjacent nervi vasorum sets up vascular changes, which in turn bring about epithelial changes in more distal areas, and the process thus advances anteriorly. This theory, though it may partly explain the condition when it occurs in the little toe, will hardly account satisfactorily for the constriction when it affects a finger or the great toe in which there is no deep digito-plantar fold. I believe that in ainhum there must be some peripheral neuritis in addition to the action of foreign bodies. The latter would naturally take effect more rapidly in tissues subject to nerve disturbance. In leprosy, for example, perforating ulcers are often set up by the patient treading with his anæsthetic foot on a sharp stone or piece of broken glass. It is very difficult to obtain anatomical proof of neuritis in ainhum, for the condition is not a fatal one, and patients are usually lost sight of after ampu-

[1] Lancet, Sept. 25, 1886, p. 576.

tation of the affected toe. I have never met with an account of a dissection of the nerves above the constriction after death. In 1889 Mr. Targett showed for me at the Pathological Society of London two fingers from anæsthetic lepers, showing constrictions remarkably like those of ainhum. The specimens are now in the College of Surgeons Museum. Since that time I have met with several similar examples occurring both in fingers and toes. The following are brief notes of 9 cases:

1. M. W., negro, aged 46; anæsthetic leprosy for eighteen years. The left middle finger is shortened from absorption of bone. The last phalanx is very small and placed on a broad base, composed of the first and the remains of the second phalanx. There is a constriction round the proximal end of the last phalanx, as if a piece of skin had been tied tightly round it. The last phalanx was removed with scissors. There was no bone at the constriction. The nail at the end of the finger was intact.

2. M., Hindu, aged 45; anæsthetic leprosy for fourteen years; left forefinger swollen; a sinus at the end leads to dead bone. There is a constriction round the swollen finger like that of ainhum. The finger was amputated. Three years later a similar constriction was found round another. Through an oversight my notes do not say at what parts of the fingers these constrictions were.

3. J. C., negro, aged 60; mixed leprosy for fourteen years. One of the smaller toes of the left foot shows a groove-like ainhum. The toe was amputated. No bone was found at the site of amputation. It was replaced by thickened fibrous tissue.

4. E. R., negro, aged 31; anæsthetic leprosy for six years. Over the last joints of the right middle finger is a commencing constriction like ainhum. The tip of the finger was amputated with scissors.

5. I. C., colored Spaniard, aged 47; anæsthetic leprosy for twenty years. The right fourth toe hangs by a narrow pedicle. It was amputated with scissors.

6. S. A., negro, aged 42; anæsthetic leprosy for nine years. The end of the right little finger is atrophied and there is a deep constriction separating it from the rest of the finger. It was amputated with scissors.

7. A., Hindu, aged 26; anæsthetic leprosy for nine years. Round the first phalanx of the left great toe is a marked constriction. Patient says the constriction began after the removal of bone from the plantar surface. The constriction now passes through the cicatrix. The end of the toe is slightly swollen. The nail is intact. The constriction went on deepening. Eventually both the toe and metatarsal bone had to be removed for necrosis. Five years later a deep constriction was discovered round the right fourth finger of the same patient at the base of the nail. This constriction also was attributed by the patient to removal of bone. There was much thickening of the bone just below the constriction.

8. M., Hindu, aged 54; anæsthetic leprosy for ten years. Round the end of the right middle finger is a deep constriction like ainhum. The bone has disappeared. The end of the finger was removed.

9. M. X., colored, aged 25, anæsthetic leprosy for six years. Round the great toe are two constrictions like ainhum. That near the distal end is ulcerated and bleeding. A sinus was slit up in the toe and a large piece of phalanx was removed. It was necrosed, loose in the cavity, and had a very offensive odor.

These nine cases have certain points in common. The leprosy had lasted a long time, there was much anæsthesia, and there was a constriction resembling that sometimes seen in the bark of a tree when the tree has gone on growing while some substance has been tied round it. In addition to this, there was in several of the cases either dead bone, or a cicatrix, showing that bone had been removed. No. 7, a patient of considerable intelligence, dated each of his two constrictions from the removal of bone. The sequence of events, I think, is very probably as follows: Peripheral neuritis causes anæsthesia and necrosis of bone. This dead bone acts as a foreign body, just as the grit or sand mentioned by Eyles in ainhum. Hyperplasia is thus set up with the consequent changes already described. A difference in leprosy is that constriction is not always limited to one toe and one part of the toe, but may occur almost indiscriminately in any finger or toe and over any joint or phalanx. It is probable that the transverse direction of the furrow is decided by pressure directed against the weakened end of the finger or toe after loss of bone. This seemed to be shown in case No. 7, in which the patient, having lost his other fingers, used to hold his spoon and other things between the thumb

nd end of the fourth finger. It is conceivable that the movement backward and orward thus set up would soon increase the hyperplasia and other changes where he bone had been lost and thus produce a constriction. I think that further tudy and dissection of these leprous constrictions, combined with dissections, if ossible, of the nerves in ainhum, will probably throw much light on the later bscure affection.

6. Ophthalmic Lesions.

A volume might be written on the affections of the eye occurring in leprosy, ut space will only permit a very brief allusion to them. In tubercular leprosy arious changes may take place from the deposit of tubercles in the conjunctiva. These changes, being associated with the presence of a distinct local growth, do ot answer the present inquiry. In the other forms of leprosy more obscure esions occur Ophthalmia is the most frequent; it is complicated occasionally vith pannus. Ulcer of the cornea is also by no means uncommon; it is sometimes followed by onyx, hypopyon, or other varieties of abscess, by perforation of he cornea, or by iritis with resulting synechia. In some cases the ulcer may heal nder treatment, leaving usually some corneal opacity. In other instances, fortunately rare, panophthalmitis is set up, and the eye is rapidly lost. In all these onditions we are at once faced by the old difficulty as to the condition of the eye nd face We know that when the trigeminus of a rabbit is divided in the skull here is loss of sensation in the parts of the face receiving its sensory fibers. Vithin twenty-four hours the cornea becomes cloudy, and an inflammation follows which may end in total disorganization of the eye. At the same time the asal cavities of the same side are inflamed and ulcers often occur on the lips and uns. Snellen, however, found that the inflammation of the eye might be greatly essened or altogether prevented if the organ were carefully protected from the ritation of foreign bodies. Hence he argues that the changes are due to injuries roduced by these foreign bodies on a surface no longer protected and guided by ensation. Other observers, on the other hand, have failed to obtain Snellen's esults. In leprosy we have a condition closely resembling the effect of section of he trigeminus. The cornea is often more or less anæsthetic, sometimes absolutely , as in case 2, in which I was able to extract a cataract without any artificial næsthetic and without any evidence of pain or sensation on the part of the atient. The question therefore becomes the same as that already discussed in Charcot's joint disease, "Are the ophthalmic lesions the result of injuries to eyes endered anæsthetic by leprous deposit in the sensory nerves, or are they caused y leprosy of distinct trophic fibers?" From the frequency with which these esions yield more or less to local treatment, and also from the fact that in some istances they can be traced to the direct impact of foreign bodies, such as whitewash in the case of patients who clean the ceilings of the wards, it would seem hat the former is the more probable hypothesis.

7. Zona.

I have observed zona seven times in lepers during a period of six years. When is remembered that interstitial neuritis is the most common lesion in zona, it somewhat surprising that the latter affection is not more common in leprosy. adcliffe Crocker points out that the occurrence of cases in groups suggests the ossibility of atmospheric influences as an existing cause of the disease. This most epidemic occurrence of zona is sometimes noticeable in Trinidad both in pers and those free from leprosy. In the asylum I have seen patients in adjoing beds attacked with zona one after the other, a fact which might be seized pon by unscientific observers to prove the contagiousness of zona, just as the fact one patient after another becoming leprous has been brought forward to show

that leprosy is contagious. Amongst the general population of Trinidad it has occasionally happened that many persons have been attacked almost simultaneously with zona. Charcot specially mentions zona as occurring in the course of locomotor ataxia. Another is thus added to the many points of resemblance between the trophic lesions of tabes and leprosy.

These imperfect notes may perhaps help to emphasize the fact that some of the most interesting lesions in leprosy have their prototypes in diseases already described in Europe or elsewhere, and the complexity of many of the questions raised may serve to recall the Socratic dogma, that he is a wise man who learns that he knows nothing.

THE QUESTION OF THE COMMUNICABILITY OF LEPROSY.

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From the earliest times leprosy has been regarded as communicable from one person to another. Under the Mosaic dispensation and in mediæval Europe there were stringent regulations providing for the segregation of those suffering from the disease. This ancient opinion as to the communicability or contagiousness of leprosy has not entirely held its ground in this century, and I propose to-day to briefly discuss some of the modern evidence for and against the theory of contagion. The subject may be conveniently considered under the following six heads: (1) Bacteriological evidence; (2) inoculations of animals; (3) inoculations in the human subject; (4) vaccination; (5) practical experience; (6) alleged increase of leprosy.

1. Bacteriological evidence.

To Hansen, of Bergen, is due the epoch-making discovery of the leprosy bacillus, and the inauguration of a new and scientific study of the disease. He first advocated the parasitic theory of leprosy in 1869. For some years, however, he was in much doubt on the subject. Writing in 1875,[1] he says:

> There are to be found in every leprous tubercle, extirpated from a living individual, small staff-like bodies, much resembling bacteria, lying within their cells; not in all, but in many of them. Though unable to discover any difference between these bodies and true bacteria, I will not venture to declare them to be actually identical.

In 1880[2] he was able definitely to announce the discovery of a specific bacillus in leprosy, and Neisser,[3] in the autumn and winter of the same year, working at the San Lasaro Leper Hospital, at Granada, Spain, confirmed Hansen's results and applied the anilin-color tests, which have since been recognized as distinguishing the bacilli of leprosy and tuberculosis from those of other diseases. Neisser found bacilli in the cutaneous nodules, the mucous membrane of the mouth, palate, and larynx, the connective tissue of the peripheral nerves, in cartilage, and in the cornea, lymphatic glands, spleen, liver, and testicle. Since then Hansen's discovery has been confirmed by observers in all parts of the world, and it may now be affirmed that the leprosy bacillus is present in some part or parts of the body of every leper at some period or other in the course of the disease. Leprosy being thus associated with the constant presence of a microbe, which is

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[1] Med.-Chi. Review, 1875, p. 489.

[2] Virchow's Archiv, 1880, Band 79, p. 31.

[3] Virchow's Archiv, 1881, Band 84, p. 514.

ow believed, though not proved, to be the cause of the disease, there has been oo great a tendency to assume that leprosy is therefore contagious. It is only ecessary to mention malaria and pneumonia as two instances of infectious dis-ases which are by no means contagious.

It may now be well to examine the results which have attended the attempted ultivation of the bacillus lepræ. Hansen[1] kept specimens of leprous blood in a oist chamber and obtained a mycelial growth, which at that time he called a eprosy culture. It is, however, probable that the growth was due to contamina-on of the specimen, and Hansen has since abandoned his original view. Neisser,[2] hen working at Granada, removed an unbroken tubercle with every precaution, nd finely divided it with needles sterilized in a flame. He then inoculated blood erum in hollow, ground, microscopic slides, in sterile test tubes, and under cover lasses in a space where evaporation was checked. All the preparations were ept at 35° to 39° C. He also kept pus and juice from a leprous nodule in capillary lass tubes, which contained much air and were sealed. As a result of these culti-ation experiments he describes three different bacilli. He failed, however, to ultivate any of them in generations, and it is therefore impossible to be certain hat he got a true culture. Arning[3] allowed pieces of leprous tissue to macerate nd decay for several months in water at ordinary temperatures, and described rowths of the leprous bacillus, but he did not regard these as real cultivations.

At the Trinidad Leper Asylum[4] I made an extensive series of cultivation experi-ents extending over about three years. As nutrient media I used blood serum, scitic fluid, hydrocele fluid, all from the bodies of lepers, and various combina-ons of agar and gelatine with these fluids. Pieces of cutaneous leprous nodules, f lymphatic glands, and of nerves were used for inoculation, also fragments of e viscera of lepers and vaccine lymph. Numerous growths of staphylococci of rious kinds were obtained, but no cultures of leprosy bacilli. Inoculations of imals with the growths were negative. Results obtained by allowing pieces of bercle to putrefy in fluids were equally negative; nor did I observe the abun-ance of leprosy baccilli described by Arning in the earth in which lepers had been uried. To test this point, I buried leprous hands and other specimens and dug em up at varying intervals. Examinations of the surrounding earth failed to ow any specific bacilli.

Delépine and Slater[5] made numerous attempts to cultivate the leprosy bacillus two different periods during the life of a leper, but without success. In 1887 ordoin Uffreduzzi,[6] of Tunis, announced the cultivation of the bacillus lepræ. aving failed, like other experimenters, to grow the bacillus from pieces of lep-ous nodules implanted in solid media, he considered that the bacilli in these odules are inclosed in cells and are probably dead. He therefore examined other ssues, and in the bone marrow of a dead leper he found free bacilli. He inocu-ted tubes of peptone-glycerin-serum with fragments of this bone marrow and btained cultures of a small bacillus, frequently bulbous at the ends and resembling form and size the bacillus of the tissues. It, however, took the fuchsin stain ith far more difficulty than the bacillus found in the tissues of lepers.

When passing through Tunis, in 1891, I called on Prof. Bordoin Uffreduzzi, who ery courteously showed me microscopic specimens from his original culture, and ive me a tube of one of the secondary cultures. I took this tube to London with l possible care, and inoculated other tubes from it in Dr. Slater's laboratory,

[1] Virchow's Archiv, 1881.
[2] Virchow's Archiv, 1881, 1886.
[3] Journ. of Leprosy Investig. Committee, No. 1, p. 40.
[4] Reports of Trin Lep. Asyl., 1888, 1889; Brit. Med. Journ., Aug. 4, 1888.
[5] Brit. Med. Journ., May 23, 1891, p. 1127.
[6] Zeitschrift für Hygiene, Band III, p. 178.

which he kindly placed at my disposal. I fear, however, some contamination must have taken place, for the subcultures which I grew differed entirely from the growth originally figured by Uffreduzzi. It may be stated here that the Italian professor made a large number of inoculation experiments on animals, but wholly failed to establish the pathogenic nature of his cultivation. Gianturco,[1] at Naples, has succeeded in obtaining a cultivation which Uffreduzzi considers identical with his own. More recently Campana,[2] at Genoa, has described a third bacillus as cultivated from leprous material. I have seen specimens from the cultures of Gianturco and Campana, but could not feel convinced that they were leprosy bacilli.

A series of culture experiments were carried out at Almora and Simla by Dr. Buckmaster, Surg. Maj. Thomson, and myself.[3] The mode of procedure was suggested by Dr. Buckmaster. Blisters were raised over cutaneous leprous nodules, and at the same time over areas of normal skin in lepers. Sterilized capillary vaccine tubes were then charged with a minute quantity of the fluid from the blister over the tubercle, and with seven or eight times as much fluid from the blister over the normal skin. The tubes were then sealed in a flame. In order to secure a constant temperature the tubes were packed with a small thermometer in a cylindrical box and carried in the axilla. After incubation for one month the tubes were opened, examined, and resealed. Several bacilli resembling that of leprosy were seen. A tube containing some of these bacilli was now sterilized as much as was possible without injury to the contents, broken at both ends, dropped into glycerin bouillon, and shaken. On the third day a slight turbidity appeared and increased daily. Minute particles collected on the surface, and, adhering together, formed a pellicle, which gradually extended from the center to the periphery. From this original bouillon glycerin, gelatine and glycerin-agar were inoculated and vigorous growths were obtained. Similar results were obtained from two different patients. Under the microscope these growths showed thick clusters of bacilli shorter and slightly thicker than the bacilli found in leprous nodules, but retaining the pink stain after treatment in warm Ziehl's solution for twenty minutes, and subsequent decolorization in 25 per cent solution of nitric acid. Subcultures from the original growths did not resist the action of the acid so well, though they stained to some extent. Rabbits, dogs, and a monkey were inoculated with small quantities of these cultures, but the results were entirely negative. We are thus unable to assert positively that the growths obtained were those of the bacillus lepræ, but that the bacillus cultivated by us had several points in common with that in the tissues is undoubted.

In concluding this section I may be pardoned for quoting the four well-known postulates which have been laid down by Koch, as necessary to show beyond a doubt that a micro-organism is the cause of a disease: (1) The micro-organism must be found in the blood, lymph, or diseased tissues of the man or other animal suffering from or dead of the disease. (2) The micro-organism must be isolated from the blood, lymph, or tissues and cultivated in suitable media outside the body. These pure cultivations must be carried on through successive generations of the organism. (3) A pure cultivation thus obtained must, when introduced into the body of a healthy animal, produce the disease in question. (4) In the inoculated animal the same micro-organism must again be found. Applying these postulates to the case of leprosy it will be evident, from the experiments of the various observers whom I have quoted, that the first is generally admitted, the second is doubtful, and the third and fourth have never yet been demonstrated.

[1] Giova. della Assoz. Nap. di Med. e Nat., 1890.
[2] Riforma Med., No. 14, 1891.
[3] Appendix to Report of Ind. Lepr. Commission, 1893.

2. Inoculation of Animals.

These may be of two kinds: (1) Inoculations with cultures. (2) Inoculations ith tubercles or other pieces of leprous tissue. We can not logically speak of oculations with cultures of the bacillus lepræ, for as was shown in the last sec-on, such a culture has not yet been demonstrated beyond possible doubt. All e can say is that cultures of bacilli obtained after inoculation of media with prous products have always failed to produce leprosy in animals. This has ready been alluded to in the last section. The other method of inoculation of imals which has been tried is by means of pieces of leprous nodule or other lep-us tissue. Neisser[1] was one of the first to inoculate animals with leprous tissue. hen working at Granada in 1880, as already mentioned, he experimented on rab-ts and dogs. Pieces of freshly extirpated leprous tubercle were introduced into e peritoneal cavity and anterior chamber of the eye of rabbits. The results in em were absolutely negative. Pieces of leprous tubercle were also placed beneath e skin of dogs. One of them died after a month, and a small nodule was found the site of inoculation. This contained numerous bacilli. Another dog was lled about three months after inoculation, and a local nodule the size of a bean as found. This contained characteristic leprous cells, but no bacilli. Neisser was opinion that a local leprosy was thus produced, which, however, did not become eneral. Damsch[2] introduced leprous tubercle into the anterior chamber of the eye rabbits, and described an infiltration of the iris, ciliary body, and Descemet's mem-rane with cells containing leprosy bacilli. Vossius[3] obtained similar results, but either of these observers found a distribution of bacilli through the body. esener, Leloir, and Campana[4] have shown that results identical with those scribed by Damsch and Vossius are obtained on implanting leprous material rdened for years in alcohol. Dead leprous bacilli even after having been so pt in alcohol retain their structure, shape, and staining reaction. It is there-re extremely probable that Damsch and Vossius did not produce a local leprous sion. Campana[5] inoculated leprous tubercle in the vascular comb and beard of wls, and often obtained at the site of inoculation a local tumor containing large cells oduced in the inflammatory process. These took up leprosy bacilli in the same ay as leucocytes take up inorganic foreign bodies. Köbner[6] and Hansen[7] tained negative results in monkeys after inoculation. Hillairet and Gancher[8] oculated a pig with leprous tubercle, but the results were negative. Vidal[9] also erformed a similar experiment, and sections of the skin and subcutaneous tissue ntaining the inserted fragment showed a year after the inoculation numbers of prosy bacilli in the implanted mass, but none in the surrounding tissue. Thia,[10] auria,[11] Avuing,[12] and Leloir[13] have hitherto failed to establish leprosy in animals.

At the Trinidad Leper Asylum[14] I have made a series of experiments extending er nine years. The animals used have been cats, pigs, rabbits, bats, guinea gs, fowls, small birds, a parrot, and a dog. The materials employed have been

[1] *Loc. cit.*
[2] Virchow's Archiv., Band 90, p. 20.
[3] Bericht der 16 Ver. der Ophth. Gesell., Heidelberg, 1884.
[4] Brit. Med. Jour., April 29, 1893. p. 912.
[5] Archiv. sulla Scienza Med., 1883.
[6] Virchow's Archiv, 1882, vol. 88, p. 282.
[7] Internat. Med. Congress, Copenhagen, 1884.
[8] Société de Biologie, 1881.
[9] Cornil et Babes. Les Bactéries, p. 761.
[10] Impfversuche mit Lepragewebe auf Thiere, 1886.
[11] Journ. Lepr. Investig. Committee, No. 2, 1891, p. 68.
[12] Report on Leprosy in Hawaii, 1886, p. xlii.
[13] Traité théorique et Pratique de la Lèpre, p. 235.
[14] Reports on Trinidad Leper Asylum, 1884 to 1892.

pieces of cutaneous nodule, discharge from ulcers, and vaccine lymph. There has been no evidence of success. In fowls the inserted nodule becomes encysted beneath the skin and then becomes disorganized. Dead bacilli can be found in the débris many months after inoculation. Bacilli have, however, never been found in any of the viscera. I fed fowls for long periods with pieces of cutaneous leprous nodule and enlarged glands and pieces of viscera obtained post-mortem, but dissection of these fowls after death failed to show any evidence of leprosy. I have now under observation two pigs, which were inoculated with pieces of cutaneous leprous nodule nearly four years ago. There is nothing to be seen or felt at the site of inoculation. In the last year these pigs have been fed with large masses of viscera and enlarged and caseating glands, obtained from the bodies of lepers. Up to the present they have seemed in fair health.

The experiments which have attracted most attention of late years are those of Melchor[1] and Ortmann[2] in Konigsberg. They introduced pieces of freshly extirpated leprous tubercle into the anterior chamber of the eyes of rabbits, and described four months afterwards a visceral and lymphatic gland lepræ. The autopsies showed the cæcum, spleen, lungs, and lymphatic glands to be infiltrated with nodules varying in size from that of a pin's head to that of a pea. In these nodules were quantities of bacilli which they regarded as those of leprosy. Arning[3] and Ruffer, who have examined the specimens of Melchor and Ortmann, are convinced that the Konigsberg experiments have succeeded in inoculating animals with leprosy. Wesener, on the other hand, has carefully gone over the same ground and critically controlled these experiments, and he concludes that proliferation of the leprosy bacilli does not occur, but merely a diffusion of the bacilli introduced. He and Hüppe believe that Melchor and Ortmann, like many others, have sown leprosy and reaped tuberculosis.

In this connection, I may allude to a series of observations at the Trinidad Leper Asylum, some of which I have recently published.[4] In a large proportion of the bodies of lepers, I have found either (1) pulmonary phthisis indistinguishable from that occurring in nonlepers, and characterized by small tubercles scattered more or less throughout the lungs, and often agglomerating, caseating, and breaking down into large cavities at the apices and elsewhere; or (2) a general diffusion of small gray or yellow tubercles throughout the viscera, and sometimes on the serous membranes. The latter condition often appears at the autopsy to be of very recent date, and from the clinical symptoms, such as fever and wasting, which come on a few weeks before death, it would seem that the appearance of these visceral tubercles coincides with the absorption of cutaneous leprous nodules which so often precedes death. We are therefore led to the conclusion that these visceral tubercles are either leprous, and due to absorption of leprous products from the skin, or they are tuberculous, and due to accidental absorption of tuberculous material quite apart from the leprosy.

I inoculated five guinea pigs beneath the nape of the neck with small pieces of pulmonary tubercle taken from three different lepers. The five guinea pigs died or were killed at periods varying from four to six months after inoculation, and in all of them were found enlargement and caseation of lymphatic glands, and small nodules in the lungs, and sometimes in the liver or spleen, or both, varying in shape, and in size ranging from about one-sixteenth to one-third of an inch in diameter. In the lungs they were translucent, and in the spleen and liver yellow or dark red in color. Microscopic examination showed bacilli indistinguishable from tubercle bacilli. As I have frequently inoculated guinea pigs with leprous cuta-

[1] Berl. Klin. Wochenschrift, 1885, No. 13.
[2] *Ibid.*, 1886, No. 9.
[3] Journ. of Lepr. Investig. Committee, No. 2, p. 117.
[4] Lancet, April 1, 1893, p. 719.

neous nodules and have always found no change whatever in the viscera after death, I am led to conclude that the above-described nodules are tuberculous in nature, and further, that they are derived from the pulmonary tubercles of lepers. If they were derived from material introduced accidentally during the process of inoculation, we should expect equally to find them following the inoculation of leprous material. This is what Wesener claims for Melchor and Ortmann's inoculations, but in my experiments, as already stated, I have never found such nodules. The obvious inference, then, is that the visceral tuberculosis so common in lepers is tuberculous, i. e., connected with the presence of the bacillus tuberculosis. But if this visceral tuberculosis is due to absorption of cutaneous leprous tubercles we are faced by a new difficulty, to which there are only two solutions: (1) There is absorption of independent tuberculous material, presumably tubercle bacilli, through the open ulcers so common in leprous tubercles. (2) The bacillus lepræ and the bacillus tuberculosis are varieties of the same bacillus, as suggested by Danielssen.[1] It is obvious that the question is by no means solved yet, but these recent experiments of mine have an important bearing on Melchor's and Ortmann's results and Wesener's criticism. I may state here that I failed to obtain cultures of either bacillus lepræ or bacillus tuberculosis from the original nodules in the lungs of the lepers, or from the nodules produced in the viscera of the guinea pigs after inoculation. From a consideration of all the evidence given in this section we are, I think, driven to believe with Besnier that leprosy is an essentially human disease and can not be transmitted to animals.

3. Inoculations in the Human Subject.

Intentional inoculations performed on man have necessarily been few. Like those on animals, they may be of two kinds: (1) Inoculations with microörganisms obtained in attempted cultures of leprosy bacilli. (2) Inoculations with pieces of tubercle or other leprous products.

Inoculations of culture products.—Healthy subjects for inoculation not being obtainable, I determined to try the effect of inoculation of culture products in anæsthetic lepers. During the latter half of 1889 I made some cultures on agar and serum and on solidified hydrocele fluid from a fragment of cutaneous leprous nodule and from a piece of liver from the body of a tuberculated leper. The microscope showed this liver to contain numerous leprosy bacilli. The growths obtained from these tissues showed no leprosy bacilli, but quantities of micrococci. Though these cultures were thus negative in not containing the specific organisms of leprosy, I thought it worth while to try the effect of injecting them, for it was quite possible they might contain other products not recognizable by the microscope. I may remark in passing that these experiments were made a year before Koch brought tuberculin before the world, and an account of them has been published.[2]

I chose 12 anæsthetic lepers and injected solutions of the growths above mentioned beneath the skin in various parts of the body. The immediate result was in most cases local swelling, redness, and tenderness, with more or less temporary rise of temperature. These symptoms usually passed off in a few days. In one or two cases, however, an abscess formed at the site of injection. The later history of the cases was as follows: Four of the patients died within the next two years of intercurrent disease. No development of tubercles was found in them, either locally or elsewhere. The eight survivors were examined by me on May 29, 1893, nearly four

[1] Archiv. Roum. de Méd. et Chir., January, 1889, p. 16.

[2] Report of Trin. Lep. Asyl., 1889; Brit. Med. Jour., January 3, 1891, p. 12.

years after inoculation. In six of them there was no thickening or any indication of the site of inoculation, and no tubercles had developed anywhere. In the two remaining patients there were in one case a thick crop of tubercles, and in the other a diffuse infiltration of the skin, together with tubercular masses on the face and ears. The following are short summaries of the cases.

Case 1.—A., Hindu, aged 38, was admitted to the Trinidad Leper Asylum on December 31, 1885, with anæsthetic leprosy of one year's duration. There were pale anæsthetic patches on the front and back of the trunk. The hands and feet were anæsthetic and the toes were ulcerated. On December 6, 1886, the left great toe was amputated. On August 29, 1887, it was noted that his condition was about the same as on admission. On December 16, 1887, a fragment of cutaneous nodule from R. G., another patient, was introduced beneath the skin of the back of the left forearm. The incision was closed with one silk suture. On December 24 there was a long ragged ulcer with thickening round it. On March 11, 1889, there was a cicatrix at the site of inoculation, but no thickening and no tuberculation. On October 16, 1889, about 10 minims of a solution of some of the growth from the liver of E C., a tuberculated leper, was injected into the back of the right forearm with a hypodermic syringe. The puncture was protected from the air. On October 18 there was redness, hardness, and tenderness over an area of about three-fourths of an inch radius from the point of inoculation. On October 23 an abscess about 1 inch in diameter had formed at the site of inoculation. It was incised and found to contain thick yellow pus. On July 28, 1890, there was no change in the patient's general condition. After this I was absent from the colony for a year and eight months, and on June 20, 1892, about six weeks after my return, I found that the patient's face and ears were tuberculated. The dispenser told me they had been so for more than a year. The tuberculation has since increased, and the following notes were taken on May 29, 1893: There is general infiltration of the skin, especially on the trunk, upper extremities, and face; there are large masses of tubercle on the face and ears; on the back of each forearm is a depressed cicatrix, indicating the site of inoculation; the skin is raised and thickened round; the fingers are enlarged and tuberculated. As I was absent from the colony when these changes began, I am unable to say whether the infiltration started from either of the sites of inoculation.

Case 2.—K., Hindu, aged 35, was admitted to the Trinidad Leper Asylum on February 20, 1889, with anæsthetic leprosy of five years' duration. There were pale anæsthetic patches over the greater part of the trunk, face, and extremities. Some of the fingers and toes were missing, and the remaining ones were anchylosed, distorted, and anæsthetic. There was no trace of tuberculation anywhere. On October 16, 1889, about 10 minims of a solution of the same growth as in the last case was injected into the right temple. On October 18 there was a small tender nodule at the site of injection about the size of a pea, with some swelling round the eye. On October 23 there was no trace of the inoculation. On April 13, 1890, there was swelling of the face and a painful nodule above the left eye. The left hand was also swollen. On October 28, 1892, I found numerous small tubercles on the nose and forehead, varying in size from that of a small shot to that of a pea. The ears were thickened and tuberculated. There were also many tubercles on the hands and feet. There was no thickening or tuberculation in the right temple at the site of injection. On May 24, 1893, it was noted that there was tuberculation of the face, ears, and hands. These parts were invaded by many small discrete tubercles. There were also a few on the front and back of the chest.

In these two cases an eruption of tubercles occurred some time after the injection in anæsthetic lepers of products derived from the attempted culture of leprosy bacilli. Whether these eruptions were *propter hoc* as well as *post hoc* is a difficult question. There are two possible fallacies: (1) The anæsthetic lepers might have developed tubercles independently of any injection. I have never seen a purely anæsthetic leper develop tubercles, but Leloir[1] quotes three cases; so we must admit the possibility. (2) The injection of an irritant such as the micrococcus may, through the febrile disturbance thus set up, have liberated bacilli already present in the peripheral nerves, and these by their entry into the lymphatics of the skin and subcutaneous tissue may have brought about tuberculation. It is evident that experiments made on subjects already leprous can only have a partial value, but

[1] *Op. cit.*, p. 209.

in view of the extremely rare occurrence of tuberculation in an anæsthetic leper the trial seemed worth making. Though no leprosy bacilli were present in the cultures, it is quite possible that some ill-defined product, such as an albumose, may have been there and may have produced the leprosis.

Inoculation of leprous tubercle or other products.—The classical example of inoculation of a healthy man with leprous tubercle is the inoculation by Dr. Arning[1] of the Hawaiian convict Kenau in the Oahu jail on September 30, 1884. The case is so well known that I need refer to it only very briefly. A small piece of leprous nodule was introduced beneath the skin of the left forearm, and a month later the patient suffered from pains in the left shoulder, elbow, and wrist, accompanied by painful swelling of the ulnar and median nerves. There was no fever and only very slight constitutional disturbance. During the next six months the neuritis gradually decreased and a small leprous nodule formed where the inoculation took place. Leprosy bacilli could be detected here sixteen months after the inoculation. In September, 1887, distinct symptoms of leprosy developed, and a year later the disease was fully established. Though at the time Dr. Arning made the experiment he was assured by Kenau himself and by those who knew him that his family was free from leprosy, yet it afterwards came out[2] that his son, nephew, and maternal first cousin were lepers, either before or after the date of the inoculation. It would thus appear that in addition to the strong racial predisposition to leprosy which exists in Hawaiians, there was in Kenau's family a peculiar aptitude for taking the disease. It is therefore quite possible that he may have had latent leprosy when he was inoculated. Moreover, as Arning points out, we have at present no criterion of the living leprosy bacillus, and it is therefore quite possible that the bacilli in the inoculated nodule may have been dead at the time of the experiment. From whatever point we look at it, we can by no means regard this inoculation as conclusive, and Arning himself freely admits that it is not a crucial test.

Nearly forty years ago a Norwegian physician[3] inoculated himself and 20 healthy individuals with blood, fragments of cutaneous nodules, or with blood or pus from such nodules. All those who were inoculated were watched for many years, but all remained healthy. Profeta[4] inoculated himself and 9 other healthy people. The observations extended over a period of sixteen years, and were absolutely negative. The materials used were pus from leprous ulcers and blood from tubercles and from anæsthetic patches. These were rubbed into the scarified skin or into raw surfaces produced by blisters or injected beneath the skin by means of a Pravaz syringe. Similar experiments have also been made by Danielssen, Holst, and Titsch,[5] all with negative result. Hansen[6] inoculated anæsthetic lepers with material obtained from tuberculated lepers, but no development of nodules took place.

In the Trinidad Leper Asylum I inoculated 30 anæsthetic lepers in December, 1887, and January, 1888, with fragments of cutaneous leprous nodules.[7] In 1889 3 more anæsthetic lepers were inoculated with pieces of nodule taken during acute leprosis (i. e., fever accompanied by an outbreak of tubercles). I thought that possibly during these acute attacks the cutaneous nodules might contain living bacilli, and thus their inoculationmi ght be followed by a development of the disease. Since the inoculations were performed 9 of the patients

[1] Eine Lepra-Impfung beim Menschen. Deutsch. dem. Gesellsch., Prag, 1889.
[2] Dr. Swift. Occid. Med. Times, April, 1890, p. 171.
[3] Leloir, *op. cit.*, p. 237.
[4] *Ibid.*, p. 238.
[5] Brit. Med. Journ., April 29, 1893, p. 912.
[6] Leloir, *op. cit.*, p. 238.
[7] Berlin, Klin. Wochensch., January, 1891, p. 25.

have died and 1 has left the asylum. In none of them was any development of tubercles noted. The remaining 23 were examined on May 29, 1893. Twenty-two of them were then absolutely free from tubercles, though in 1 there had been, three months after inoculation, a subcutaneous nodule to the outer side of the cicatrix about the size of a small shot. This, however, had disappeared in another month. The twenty-third is the patient already described under case 1 as having been also injected with culture products. It is, therefore, evident that we can not say whether he became tuberculated as a result of the leprous nodule inoculation, of the culture injection, of both of these, or independently of them.

Putting all the inoculations together we find that out of a total of 40 anæsthetic lepers inoculated with either tubercles or cultures, or both, two developed tubercles afterwards, but it is impossible to say if this was the result of the inoculation. Thus the evidence hitherto obtained from experiments performed on man may be regarded as almost entirely negative, no case being beyond the possibility of doubt.

4. Vaccination.

Of late years the anti-vaccination party, after exhausting every other argument against vaccination, has endeavored to show that leprosy is often spread in this way. Probably the case which is most often quoted is that published by Gairdner[1] in 1887. A doctor in a tropical island vaccinated his own child from a native child who afterwards became leprous. Another white child was vaccinated from the doctor's child, and both these children also developed leprosy. Though Prof. Gairdner carefully avoided expressing any opinion, and merely gave a statement of such facts as were known to him, the case was at once seized upon by those anxious to prove the communicability of leprosy by vaccination. A perusal of the case, however, shows that the details are very few, and insufficient to establish any conclusion. Moreover, leprosy was endemic in the island, so that the possibility of deriving it from outside sources was always present. Daubler[2] two years later published an account of two women on Robben Island, Cape of Good Hope, both of whom he believed contracted leprosy through vaccination. They were vaccinated with lymph obtained from a patient who afterwards died of tuberculated leprosy. In the first patient the site of inoculation swelled a few days after the puncture and became brown, but no true vaccine vesicle formed. After the swelling had subsided fever and rigors occurred, and by the eighteenth week there was a discolored tumefaction of the right frontal eminence. The second patient two months after the vaccination showed the typical leonine aspect of a tuberculated leper. These cases are frequently quoted, but clinical experience does not warrant the belief that such a chronic disease as leprosy is produced so soon after inoculation. More recently a long series of cases by Dr. Roger Chew, of Calcutta, has been published. In these cases, also, an attempt was made to show that leprosy was communicated by vaccination from diseased to healthy persons. The details, however, are very scanty, and the cases are open to the same objection which obtains in those already quoted. In Bengal there are districts where the percentage of lepers is as high as or higher than in any other part of India, though, as will readily be seen by a reference to the annual reports on sanitary measures in India, Bengal is by no means the most vaccinated province.

The proposition may be stated as follows: If vaccine lymph be taken from a child in a locality where leprosy is endemic, and if such lymph be sent to a country free from leprosy, and a healthy child in such country and who had never quitted the country, be vaccinated with such lymph, and if this child after vaccination and without leaving the country, develop leprosy, then it may be taken as proved that

[1] Brit. Med. Journ., June 11, 1887, p. 1269.

[2] Monat. für Prakt. Dermat., Band VIII, 1889, p. 123.

leprosy is communicable by vaccination. Probably this experiment has never been tried, for residents in Great Britain or other non-leprous countries would not be likely to send to the tropics for lymph. An experiment somewhat approaching the hypothetical one mentioned above has, however, been performed in India. Surg. Maj. Pringle[1] says that during a period of twenty years, from 1864 to 1884, when sanitary commissioner in the northwest provinces, he was in the habit of bringing vaccine lymph down from British Garhwal, a markedly leprous district, and using it for vaccinating in the plains between the rivers Ganges and Jumna. The first census return—1867 to 1872—shows that whereas the proportion of lepers in British Garhwal was 20 to 30 per 10,000, that in the plains between these two rivers it was only 1 to 5 per 10,000, with the exception of Etah, which showed 5 to 10 per 10,000. Here, then, we have an approach to a scientific experiment. Children in a district where leprosy is comparatively rare are vaccinated with lymph from another district where the disease is many times more common. If, then, vaccination is responsible for spreading leprosy we should expect an increase of the disease in this particular district. As a matter of fact, however, on comparing the first two census returns for the districts in question we find the following statement:

Years.	British Garhwal.	District between Ganges and Jumna.
1867 to 1872	20 to 30 per 10,000	1 to 5 per 10,000, except Etah, which has 5 to 10 per 10,000.
1881	10 to 20 per 10,000	1 to 5 per 10,000, including Etah.

Thus not only has leprosy fallen in British Garhwal from 20 to 30 per 10,000 to 10 to 20 per 10,000, but in the district vaccinated with lymph from British Garhwal the proportion of lepers has remained stationary, with the exception of Etah, which shows a reduction from 5 to 10 per 10,000 to 1 to 5 per 10,000. As Dr. Pringle was on duty from 1864 to 1884, and the number of individuals vaccinated with the lymph under consideration was gradually accumulating all these years, making due allowance for removal by death and other counteracting influences such as the diminution of leprosy in British Garhwal, we should expect that by 1881 the figures would show some evidence of the increase of leprosy which is alleged to follow the use of lymph collected in leprous districts. This increase, however, does not appear in the census returns.

It will be well to examine now the various direct experiments which bear on the subject of vaccination and leprosy. Arning[2] in Hawaii vaccinated three lepers and examined the vesicles. He found bacilli in the lymph and crusts in a case of extensive tuberculated leprosy, in which the skin contained bacilli. In two cases of pure anæsthetic leprosy he found no bacilli. In the Trinidad Leper Asylum[3] I made twenty-seven examinations of pure and impure vaccine lymph from vesicles raised in tuberculated, anæsthetic, and mixed lepers. Ehrlich's method of staining failed to show leprosy bacilli in any of the specimens, and animals vaccinated with lymph from lepers did not develop leprosy. I also vaccinated an anæsthetic leper with lymph from a mixed leper. Typical vesicles rose and ran the ordinary course, but there has been no development of tubercles. This experiment was done seven years ago. Dr. Simpson vaccinated some lepers in Calcutta, and stated that he found bacilli in the vaccine lymph. Unfortunately

[1] Leprosy and Vaccination, Brit. Med. Assoc., Bournemouth, July, 1891.
[2] Report on Leprosy in Hawaii, 1886, p. 45.
[3] Brit. Med. Journ., Aug. 20, 1887, p. 433.

when I was in Calcutta my time was so short that Dr. Simpson and I missed one another, though we attempted to meet. I thus lost an opportunity of seeing his specimens. At the Almora Leper Asylum[1] unusual facilities were offered, through the kindness of the authorities, for making an exhaustive study of vaccine lymph from lepers. Accordingly, Dr. Buckmaster, Surg. Maj. Thomson, and I caused all the available lepers to be vaccinated. Eighty-seven were vaccinated, and 40, 21 males and 19 females, developed vesicles which were examined. Of the 40 cases 34 were anæsthetic, 5 were mixed, and 1 was tuberculated. The condition of the skin at the point of vaccination was as follows: In 14 cases it was normal, in 13 cases there was an anæsthetic patch, in 12 cases sensation was diminished, and in 1 case there was tuberculation. The condition of the vesicle was as follows: In 31 cases normal, in 2 cases purulent, in 2 cases purulent and mixed with blood, in 1 case normal on one arm and purulent on the other, in 1 case normal but mixed with blood in taking, in 1 case immature, in 1 case immature and mixed with blood in taking, and in 1 case immature and the crust taken. Crusts were also taken from two vesicles which had been normal. Ninety-three cover glasses were prepared, and in no case were leprosy bacilli undoubtedly found. Suspicious looking rods taking fuchsin were seen in one case in vesicles raised over tuberculated ears, and in another case in vesicles over anæsthetic patches. But even if we were to consider these cases positive, and give them their utmost value, they would have little or no bearing on the question at issue, for no vaccinator would be likely to vaccinate a leper over a tubercle or anæsthetic patch and use the lymph obtained from such vesicle for vaccinating healthy individuals. Assuming the presence of bacilli to be necessary to produce leprosy, this series of observations, the most extensive yet made, goes to show that no danger need be apprehended from the vaccine lymph of even an actual leper, provided he is vaccinated on apparently normal skin.

From a consideration of the various arguments brought forward in this section we may therefore conclude that there is no danger of transmitting leprosy by using as a vaccinifer a child born of a family in which leprosy exists.

5. Practical Experience.

Almost all the alleged instances of communication of leprosy from one person to another have occurred in countries where the disease is endemic, and are therefore open to the objection already referred to under previous headings, viz., that the leprosy may have been derived from outside sources. As an impartial observer I may record the following case which has come under my notice during the past year. It is a typical example of the histories so often quoted, but it has the additional merit that to a great extent I was able independently to verify the dates:

J. R., negro, aged 49, consulted me at Diego Martin on July 5, 1892, for a perforating ulcer of the foot. On examining him further I discovered anæsthesia of the upper extremities, and decided that he was an anæsthetic leper. He then told me that five years ago he was living for six months at Cocorite with M. A. T., a notoriously bad character, who had previously been discharged from the leper asylum for misconduct. At that time he said he was healthy. About two years after he left the woman ulcers formed on his feet, and he lost sensation in his hands. At that time I had entirely forgotten that I had ever seen the man before, but some months later when I was looking through the register of our patients for other purposes I happened to come upon his name under date of July 21, 1890. He was entered in the register as a doubtful case of leprosy and as living at Mucurapo. Thus an unexpected corroboration was afforded of the patient's statement as to dates, for at that time, according to what he told me, he must have had initial symptoms for about six months, and it is evident that they were not sufficiently clear to justify more than a doubtful diagnosis.

[1] Journ. of Lepr. Investig. Com. No. 4, Dec., 1891, p. 32.

During our investigations in India we were brought in contact with many cases of supposed contagion of leprosy. As will be seen on reference to the Report of the Leprosy Commission[1] all these cases broke down on examination, with the exception of that of a sweeper at the Calicut Leper Asylum, who had been employed in dressing the ulcers of the inmates for twenty-three years. Two years before our visit he had developed leprosy. Even in this case there was a discrepancy as to dates, an old inmate of the asylum asserting that the sweeper had suffered from leprosy for at least six years, but that he was apparently healthy twenty years ago. The extreme difficulty in getting any coherent statement as to dates from an Oriental is, however, so well known that we must concede to this case whatever value it possesses. The dates given by the two men are fairly approximate. The death of Father Damian from leprosy is familiar to all, but here again we have no evidence that he contracted the disease from a leper. Leprosy is so prevalent in the Sandwich Islands that it is quite possible that he may have derived it from outside sources.

The only case which is free from the fallacy of concomitant variations already mentioned is that reported by Dr. Hawkly Benson,[2] of Dublin. A man, after twenty-two years' service in India, returned to Ireland with fully developed leprosy. He was shown by Dr. Benson at a meeting of the Dublin Medical Society in 1872. He died a year and a half later. During this last period of his life his brother slept in the same bed with him and wore his clothes. This brother, who had never been out of the United Kingdom, developed leprosy almost three years after the death of the first patient, and was shown by Dr. Benson at a meeting of the Dublin Medical Society in 1877. It is much to be regretted that photographs of the two brothers were not taken, but I am informed on good authority that there were present at the meetings of the society doctors who had been abroad and seen leprosy, and who were therefore capable of confirming the diagnosis.

Cases of the occurrence of leprosy in persons living in a leprosy-free country, and who had never quitted it, are also reported by Dr. Edmund Atkinson,[3] in Maryland, and by Dr. Rees,[4] in Stepney. In neither of these cases, however, was actual contact with a leper established, though in Dr. Atkinson's case there was a strong suspicion of such contact. In discussing any case occurring in a country free from endemic leprosy it must also be borne in mind that the diagnosis between leprosy and syphilis, especially in their early stages, is often extremely difficult, so that mistakes may quite possibly have occurred.

Assuming, therefore, the diagnosis to be correct, Dr. Benson's case remains as the only one in which all other possible sources of origin were excluded and in which practical experience pointed to a communication of the disease from one person to another.

6. The Alleged Increase of Leprosy.

If leprosy is communicable in any high degree we should expect a rapid increase all over the world, for segregation is not absolute anywhere. In the Sandwich Islands the most strenuous efforts have been made to isolate all the lepers. In 1868, according to official returns, there were 274 lepers. In 1888[5] similar returns showed 749 lepers at Molokai and 644 at large in the rest of the Kingdom. If these figures are correct, we must conclude that segregation in this part of the world has been powerless to check the increase of leprosy. We might, therefore, argue that the increase of the disease depends on other conditions than contact of

[1] *Op. cit.*, page 274.
[2] Dublin Journ. of Med. Sci., June, 1877.
[3] Leloir, *op. cit.*, p. 309.
[4] Monro. Leprosy, p. 45.
[5] Bienn. Rep. of Pres. of Board of Health. Honolulu, 1890.

the healthy with the affected. It is, however, only fair to state that segregation in Hawaii has always been improperly carried out.

In Memel,[1] according to Dr. Rosenthal, there has been a development of leprosy in recent years. Before 1882 no case of the disease was known. In that year a peasant near Memel was attacked and in the next nine years seven new cases occurred. Dr. Rosenthal has not been able to trace the spread of the disease to communication of one person with another or to importation from Russia. Thus, even in places where leprosy appears to have increased, we can by no means argue that it has spread from the diseased to the healthy. If we now turn to some countries where for many years little or no trouble has been taken to insure absolute segregation, we shall find that the published figures by no means bear out the theory of communicability.

Trinidad.—Only three official enumerations of lepers have been made in Trinidad since the island was ceded to the English. In 1813 Sir Ralph Woodford, wishing to establish a leper asylum, caused an official inquiry to be made as to the number of lepers in the island. Seventy-three were then found. In 1815 the question of the founding of this asylum came before the legislative council, and the same governor ordered another inquiry. This time the result was 77. The population of Trinidad at that time was given as 32,000. The next and last inquiry[2] was ordered by Sir William Robinson and was completed in 1890. Every effort was made to obtain full returns, the chief sources of information being the district medical officer and wardens. The result showed a total of 414 lepers, of whom 210 were inmates of the leper asylum. The census next year showed the population of Trinidad to be 200,028. Working out the percentages from the above figures, we find that the percentage of lepers in 1815 was 0.242, while that in 1891 was 0.206. It must in fairness be stated that the latter figures are not quite accurate, for the leper enumeration was completed in 1890, while the general census was taken in the next year. The figures, however, are sufficiently approximate. It is greatly to be regretted that no leper census was taken in Trinidad in 1891, as was done in India.

There are several obvious fallacies in any enumeration of lepers: (1) Cases may be overlooked or purposely concealed. (2) Persons may be returned as lepers who are suffering from other diseases. Almost every year patients are sent to the Trinidad Leper Asylum who are found on examination not to be lepers. In India we found that as many as 10 per cent of the cases sent to us were not cases of leprosy. (3) The same case may be reported under two or more names by different observers. A patient in Trinidad frequently has two or three names. (4) There are often several patients of the same name, especially among natives of India. Thus two or more cases occurring in patients of the same name may be put down as one case only. We may regard these different factors as to a great extent counteracting one another, and look upon the figures obtained as conveying a fair idea of the truth. The question may be stated in another way: If there were 77 lepers in a population of 32,000 in 1815, how many ought there to be in 1891 with a population of 200,028? The answer, when worked out, is 481. There is another aspect of the question. The average percentage of deaths at the Trinidad Leper Asylum for the past sixteen years is 11.1. Therefore the number of lepers dying in the whole of Trinidad in a year ought to be between 40 and 50. In 1892, 23 lepers died in the leper asylum, and the registrar general's returns show 27 deaths from leprosy in the rest of the island. The total deaths are thus exactly 50, the number arrived at by the previous independent calculation. The query naturally suggests itself: Do more than 40 or 50 new cases occur in a year? From

[1] Arning. Die Gegenwärtige Verbreitung der Lepra in Europa, 1891, p. 6.
[2] Report on Trinidad Leper Asylum for 1892.

what I know of the western end of the island, which includes Port of Spain, and is the most densely populated and the most infested with lepers, I should very much doubt it. I see a good many new cases, but not nearly enough to suggest a total of 40 or 50 for the whole island. It may be objected that the worst cases are admitted to the leper asylum, and therefore the mortality is higher there; but against this must be placed the fact that good food, hygienic surroundings, and medical and surgical treatment probably prolong life in many patients who would soon die outside the asylum. This view is borne out by the miserable and half-dying condition in which patients are often readmitted after they have been out for some time, and by the rapidity with which they improve again after they have been back a few weeks. From the above considerations it would appear that the available figures for Trinidad show that leprosy has not increased in that island relatively to the population, but, if anything, has slightly decreased.

India.—The recently published report of Mr. I. A. Baines, the Indian census commissioner, shows an absolute decrease in the leper population of India since the last census. The results of the two last enumerations are, in 1881, 131,660 lepers; in 1891, 127,056 lepers. There is thus an absolute decrease of 4,604 in the last ten years. Mistakes and omissions no doubt have been made by the native enumerators, but these obtain in both censuses, and the probability is that diagnosis has been more exact in the last enumeration. One very important point requires comment. In the census of 1881 no lepers were returned from upper Burmah, Rajpootana, Travancore, and the Central Province States. The census of 1891 shows 3,504, 1,708, 968, and 1,259 lepers, respectively, for these places, or a total of 7,439. It is, to say the least, extremely unlikely that in 1881 there were no lepers in these four large tracts of country; so that we may conclude that most probably the actual total decrease of lepers in India during the last ten years is very much greater than that shown in the census returns.

Norway.—The official returns for the whole of Norway[1] showed in 1856, 2,900 lepers, and in 1885, 1,195 lepers. During this period of thirty years annual leper returns have been made. These show that the disease has been either stationary or decreasing every year, except 1859, when a slight rise is shown. Until 1885 there was no law compelling the isolation of lepers. Dr. Kanria,[2] in a short paper which he sent me the other day, makes the following remarks:

La loi de 1885 sur l'isolement des lépreux a donné lieu à de vives critiques, attendu qu'on l'a trouvée trop rigoureuse. La loi permet en effet dans certains cas, et même sans l'assentiment des malades, à hospitaliser tel ou tel lépreux qui ne peut pas ou ne veut pas vivre dans un isolement suffisamment efficace d'avec sa famille ou son entourage; la loi va jusqu'à permettre la séparation de deux conjoints, après avis préalable du pasteur et approbation du préfet.

Dr. Kanria goes on to show that during the eight years which have elapsed since the law was passed 99 lepers have been admitted to the Reknaes Asylum, of whom only 14 came in by reason of the new law. He does not state what is the present leper population of Norway, but I think the above figures and dates are sufficient to show that the decrease of leprosy in Norway has been almost if not entirely independent of compulsory segregation.

Iceland.—The evidence obtained from Iceland is even more striking than that from Norway. Mr. Jealpeson,[3] who visited Iceland last year, writes as follows:

Leprosy, of which I had the good fortune to see a great many cases, is on the decrease in Iceland. The deaths from leprosy in 1768 were 73 per 1,000, and 1868 were 15.7 per 1,000. In 1888, in the south of Iceland, there were known to be only 148 lepers, and in 1892 only about 35. There seems to have been no attempt at segregation in Iceland, and the above figures speak for themselves.

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[1] Abraham. Leprosy: a Review of some Facts and Figures, 1889, p. 16.

[2] Om Loven af 6te Juni 1885 Angaaende Spedalske Afsondring, p. 9.

[3] Lancet, May 20, 1893, p. 1223.

North America.—The parts of North America to which those interested in leprosy first turn their attention are the Northwestern States. Here Norwegian immigration has been going on for the last fifty years. Dr. Charles Hewitt[1] makes the following concise and apposite remarks on an interesting paper by Dr. Gronvald:

It relates, in very conservative language, the experience we have had for the last forty years with leprosy in Minnesota. In no other State that I know of are all known lepers registered and kept under observation and all suspected cases carefully looked into. The history of these cases has been very thoroughly studied. No further isolation than the use of their own beds and utensils is required, and this their own good sense and that of their relatives, as a rule, secures. It must be understood that the state board of health and the local boards have abundant power to enforce the strictest isolation, if found needful; but up to date there has not been any occasion for the use of such power, as the disease is limited to the immigrants, and has never appeared in the descendants of lepers, nor in anyone born in the State.

Dr. Gronvald[2] concludes his paper by the following quotation from Dr. Hansen, who visited America in 1888 to study leprosy in the immigrated Norwegians and their descendants:

Of about 160 lepers who have immigrated into the three States named (Wisconsin, Iowa, and Minnesota) 13 are alive, whom I have seen myself, and perhaps 3 or 4 more. All the others are dead. Of all the descendants of lepers (and that includes the great-grandchildren of some of them), not a single one has become leprous.

Comment on these figures is needless. It is evident that the supervision above referred to only implies a very partial segregation, and in this experience in the Northwestern States of North America we have, I think, one of the strongest arguments not only against heredity but also against contagion.

Summing up the evidence derived from the above five countries we may draw the following conclusions: (1) In Trinidad there has been probably not much change in the proportion of lepers to the general population, but if anything there has been a slight decrease. (2) In India there has been a marked absolute decrease. (3) In Norway there was a steady decrease long before compulsory segregation was thought of. (4) In Iceland there has been a rapid decrease of late years and the disease is now almost extinct, without any attempt at segregation having been made. (5) In the Northwestern States of North America, where leprosy was not endemic, the immigration of Norwegian lepers has not been fraught with any prejudicial results to the rest of the population, nearly all the cases having died out, and no new cases having arisen, in spite of the fact that segregation has only been partial.

From the accumulated evidence detailed in the six sections of this paper I think we may fairly conclude that the risk of communicability of leprosy is so small that for practical purposes it may be disregarded, and that for an explanation of the occurrence of new cases we must look to causes other than association of the healthy with the leprous.

DISCUSSION.

Dr. Ohmann-Dumesnil, St. Louis. I have had occasion to see cases which perhaps would support the opinion of the contagionists; a woman physician, who supposed that dissecting a leper in San Francisco caused it. I have also seen cases of apparently spontaneous leprosy in St. Louis. In some of these cases the period of incubation was remarkably short; some two or three years.

Dr. W. S. Gottheil. I believe that in spite of the vast amount of argument pro and con that had been devoted to the subject, from a practical standpoint the

[1] Lancet, March 26, 1892, p. 684.

[2] *Loc. cit.*

question of the contagiousness of leprosy is a very simple one, in this country at least. Isolated cases do not present the same problems as did those in localities where larger communities of lepers exist. Even in these latter the negative evidence of contagiousness is very strong, whilst the positive is very weak. That individual cases are absolutely harmless has been abundantly demonstrated. Three lepers lived for years in the Charity Hospital of New York, in the general dermatological ward. They ate and slept with some thirty other patients, and one of them worked as a deck hand on the island boat. Nevertheless, not a single patient or attendant ever contracted the disease. An occasional leper finds his way into our cutaneous clinics, and undoubtedly others exist in the Chinese quarter. The Chinese, who know the disease better than we do, are not afraid of it. In view of these facts such disgraceful exhibitions as we had recently seen here ought to be frowned upon. To see the Governments of two great and enlightened countries like Canada and the United States bandying a poor sick leper from one to the other across the frontier in a carefully closed box car, and finally shunting him off onto a side track and handling him as if he spread a contagious miasm for a rod around him, is not edifying. And when he finally found a resting place, it was in an isolated tent on the bleakest portion of Blackwell's Island, where he finally died, probably largely on account of his exposure and privations. It is not astonishing that the cry of "leper" in the tenement quarters of the town should cause a panic worse than that of "mad dog," when the ruling and presumably better-educated classes share the absurd prejudice.

Dr. S. Pollitzer, of New York. My own experience of leprosy includes perhaps a score of cases, which I saw cursorily in London, Paris, etc., and half a dozen which I had an opportunity of studying more closely while assistant in Dr. Nuna's clinique in Hamburg. I was much impressed with the admirable presentation of the facts bearing on the contagiousness of leprosy by the reader of the paper before us, though I can not agree with what seems to me the tendency of his argument. The bacilli of leprosy have been found in great numbers in all the affected tissues in every case of leprosy ever examined; in patients the most diverse in race and in geographical position. It is not necessary to dwell on the fact that the germs can not be a mere accidental concomitant of the disease, or that their presence depends on the conditions created by the disease. They must stand in a causal relation to the disease; and if the bacillus produces the disease, leprosy certainly is, in a strict sense, communicable, and directly communicable unless we go back to the theory of an intermediary host as implied, for instance, in Hutchinson's "fish hypothesis," a theory which has absolutely no facts to support it. The failure attending the attempts at cultivation and inoculation can not be denied; but the only conclusion warranted is that the specific organisms or the disease require conditions which have as yet escaped us. The analogy which Dr. Duhring points out in lupus vulgaris of a disease due to a germ but not transmissible is, I must submit, not strictly applicable. Though we can not reproduce the clinical picture of lupus by inoculation, we can cultivate the germ and produce tuberculosis by its inoculation, while in leprosy we can neither cultivate the organism nor reproduce the disease. When Dr. Rake, with his vast experience in this field, has the floor on the rarer manifestations of nerve or trophic lesions in leprosy, most of us can not have much to say. I should merely like to ask in regard to his valuable suggestion for the treatment of perforating ulcer, is not the ulcer itself to be scraped or otherwise treated when the foot is split up? As to the occurrence in pseudo-epidemics of herpes zoster, which Dr. Rake refers to, such occurrences are not uncommon. Epidemics of zona have several times been recorded among children attending a particular school; and we have records of the disease being especially frequent in certain localities. I have been informed that zona is very common in the lower Connecticut valley during the early spring months.

Dr. ALFRED E. REGENSBURGER, of San Francisco, Cal. Dr. Beavan Rake is to be congratulated upon the masterly manner in which he has handled the subject of which this paper treats. Time forbids my discussing it thoroughly, or indeed any one part of it exhaustively. I will, therefore, only touch upon one point and that very superficially. That is with reference to the prevalence of leprosy on the Pacific Coast of the United States, of which San Francisco, Cal., where I reside and practice my profession, may well serve as an exponent, and to which the Doctor, in speaking of its distribution in this country, did not allude. Cases of leprosy can always be found in San Francisco. It is the principal city and metropolis on the Pacific Coast in the Union, as you all know. It has a population of about 320,000, of whom 40,000 are Chinese. These Mongolians are often afflicted with the malady; they are brought into intimate contact with the white population, acting as domestic servants, doing the washing to a great extent, and following other occupations which necessitate their commingling with the Caucasian race. It is necessary to an intelligent comprehension of the question to state here that they employ physicians of their own nationality, persons ignorant of the veriest rudiments of medicine. It follows that if they are suffering from the disease it will escape detection, and if by chance it be recognized, it is more than likely that it will not be reported to the health authorities, as these people are averse to so doing. It is consequently impossible to obtain reliable statistics regarding the disease. What is a still more deplorable state of affairs, if the disease be communicable, is that it is sure to spread. Besides, we are in the direct line of transit to and from the Sandwich Islands, where it prevails endemically, and where, as the Doctor very truly remarked, it is on the increase, and isolation is not as strictly enforced as it should be. There are such a number of cases on the islands that it takes over one-twelfth of the annual revenue to pay for the necessary sanitary supervision and arrangements to care for their lepers. In view of these facts, is it astonishing that any physician; yes, any sanitarian or public-spirited citizen, coming from my section of the country, should be deeply interested in this matter? Still more so, when I tell you that we have in San Francisco a place designed for the reception and treatment of lepers, formerly known as the "pest house," but lately called by the more reassuring name of the Twenty-sixth Street Hospital, where you can always find a dozen or more cases of leprosy, the majority or frequently all of them being Chinese. Now and then it has been customary to ship these patients back to their homes and to the places whence they came. As soon as one batch of Chinese is sent back another lot is there to fill their empty places. Bearing the foregoing facts in mind, I contend that if leprosy be communicable, which I believe it to be, or if there be the slightest doubt concerning its non-communicability, it is no more than right that proper legislative enactments be put upon our statute books and, when there, strictly enforced, looking toward preventing further immigration from these leper-infected countries, and that the most stringent sanitary measures be had recourse to by strict isolation and otherwise to prevent its propagation from those affected by it who are already in our midst. In the present stage of our knowledge it is indubitably our duty to regard the disease as communicable, as that question is sub judice. What rôle may the bacillus lepræ or some other microörganism, of which we know nothing at present, play in making it communicable? I know that someone will ask, and that with reason and justice, Why not do the same, that is, enforce isolation, with phthisis and syphilis? Are they not communicable? Certainly they are. Let me ask, in reply, Do two wrongs make a right? This leads me to ask the question regarding the contagiousness of leprosy. May not the bacillus lepræ bear some relation to that of phthisis? Is it possible to differentiate one from the other by their reactions to coloring agents, bacteriologically speaking? These are interesting questions, which we hope may be elucidated and satisfactorily answered some day, perhaps in our time. Numer-

ous observers have reported cases which they claim were due to contagion, but they are not sufficiently convincing to have settled the matter. You may cite any number of cases where no evidence of communicability can be adduced, yet one affirmative case is of more value than any number of negative ones. To conclude, at the present time I believe leprosy to be communicable. With more light upon the subject the future may lead me to change my opinion.

Dr. WELCH. Having had very little experience in regard to the necrotic lesions in leprosy referred to in the paper, I have but little if anything to say. I have seen quite superficial ulceration in one case, but these ulcers have healed quickly, to be followed by others. I have also seen ophthalmic lesions. Atrophy of muscles, flexor muscles generally, is markedly noticeable in one of my cases.

Dr. DUHRING. I am inclined to agree with the general conclusions of the reader of the paper. Leprosy is not necessarily a contagious disease because associated with a bacillus. Bacilli are found in lupus, but this disease is not, therefore, contagious, at least practically, and the distinction must be made between a disease being practically contagious and one that is only contagious expermentally and under the most favorable conditions. I have noted in some of the cases which I have seen a long period of incubation, in some instances extending over many (ten or twelve) years, that is, from the date the subjects had been in a leprous country or had been in contact with lepers to the period of the first symptoms of the disease. This is remarkable and difficult to explain.

Dr. RAKE. Dr. Welch's case of a woman in Philadelphia who was attacked with leprosy without ever having left the country is a most interesting one, and may be compared with a similar case reported some years ago in Maryland by Dr. Atkinson. The sporadic cases mentioned by Dr. Ohmann-Dunesnil in St. Louis, and Dr. Regensburger in California, are also valuable. It is to these apparently new foci of the disease that we must especially look for information as to the mode of propagation of the disease. Careful and frequent leper censuses in such new foci, together with full notes of any cases observed, will help us far more than observations in countries like India or Hawaii, where the disease has been present for many years and where it is widely distributed. Dr. Duhring has mentioned some very long periods of apparent incubation. In the patients who have developed leprosy in Europe after residence in leprous countries the average period has been, I believe, about two years after their return. This, of course, is open to fallacy, for they may very possibly not have been exposed to leprous infection for several years before returning to Europe.

Dr. Duhring asks what is the general opinion among the other medical men in Trinidad as to the contagiousness of leprosy. Opinion on this point is divided, but I think the majority do not believe that the disease is contagious in the ordinary sense of the word. I have only seen three Europeans in Trinidad who were lepers. Two were German, and one was a Frenchman. I have heard of one or two more.

Dr. Politzer asks how leprosy is propagated if not from one individual to another? I can only suggest the same theory which is believed to be true of tuberculosis. I believe in certain localities leprosy bacilli are always present outside the body, and that residents in these localities are constantly taking the bacilli into their respiratory passages mixed with dust, or into their alimentary canals in food or water. Bacilli are also constantly settling on their skins. Those who are susceptible, from fevers, intemperance, or any other debilitating influence, become lepers, while those in normal health escape. This is of course merely a theory, for we do not yet know the conditions of life of the bacillus outside the body, or whether an intermediate host is necessary for its development before it reaches the human subject.

LAS AUTO-INFECCIONES EN LA SÍFILIS.

Por el Dr. EDUARDO R. GARCÍA,

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Durante largo tiempo se ha creído que una gran parte de las afecciones que se presentan en los sifilíticos eran debidas siempre á la sífilis; lo que equivaldría á decir que en un reumático muchas de las afecciones que en él se presentan deberían reconocer necesariamente un orígen reumatismal, lo cual está muy lejos de ser cierto. Los que así creyeren seguirían un camino erróneo, sin duda escabroso para ellos y bien peligroso para el paciente.

Pasaron ya los tiempos en los que en presencia de un caso de sífilis bastaba solo hacer el diagnóstico de la enfermedad. Hoy, gracias á los progresos de la patología interna, se disponen de nuevos elementos que han entrado en el dominio del problema patológico. Tan es así, que el conocimiento de la auto-infección ha venido á darnos cuenta de un cierto número de accidentes que se encuentran frecuentemente en los sifilíticos, accidentes que la sífilis sola no bastaría á explicar, y que el tratamiento antisifilítico es siempre impotente para curar.

En efecto, supongamos un enfermo que lleva en la garganta grandes placas mucosas ulceradas, que secretan pús y líquidos más ó menos descompuestos; estos productos en lugar de ser arrojados al exterior son ingeridos por la deglución; ahora bien, ¿que sucedería en este caso? Que el enfermo se intoxicará; que se producirán en él una série de fenómenos morbosos evidentemente independientes de la sífilis que los ha precedido, pero que no ha sido sino la causa ocasional. Esto es precisamente lo que pasa con ciertos accidentes que presentan frecuentemente los sifilíticos, tales como la fiebre, los sudores, las perturbaciones gastro-intestinales y hasta ciertas lesiones faringeas; se produce pues, en este caso, una auto-intoxicación, una infección secundaria, y en los lugares en que por cualquiera causa se establece una erosión ó una ulceración de la mucosa, estas toman desde luego un mal aspecto, que no es debido á la sífilis sino que generalmente depende de la auto-inoculación de los productos sépticos que se escurren de las otras úlceras allí existentes.

Esto es tanto más cierto cuanto que para hacerlas desaparecer no es necesario el tratamiento mercurial, el que muy al contrario frecuentemente las pone en peores circunstancias, y basta solo el esmerado aseo de la cavidad buco-faringea para conseguir su desaparición.

Podría objetárseme, y con alguna justicia, que el que no desaparezcan estas lesiones bajo la influencia del tratamiento específico, no arguye en contra de su orígen sifilítico; es verdad aparentemente, pues que hay algunas que son muy rebeldes á dicho tratamiento, más su rebeldía es ya un dato de presunción, y si á este agregamos los que nos suministran los exámenes histológicos, los análisis micro-químicos, y sobre todo la clínica, tendrémos un conjunto de pruebas conspirando todas ellas á un mismo fin, esto es, la separación completa de las lesiones sifilíticas de aquellas que no lo son.

Es también un hecho para todo aquel que haya querido observar bien á los sifilíticos en el segundo período, que su temperatura se eleva en las noches, que sudan más ó menos, y que no pocas veces experimentan un calosfrío precursor, que en una palabra, todo este síndroma complejo, llamado comunmente fiebre sifilítica, podrá conducir á un error diagnóstico, atribuyendo á la sífilis lo que en realidad puede reconocer otra causa, como lo dirémos luego; y esto solo porque ó no se examina atentamente á estos enfermos, ó se tiene ya una idea preconcebida. Las mismas consideraciones podrían aplicarse á las perturbaciones gastro-intestinales, que reconocen frecuentemente una causa identica, la auto-infección.

Mucho tiempo ha que se conocen los fenómenos morbosos determinados por la absorción de líquidos sépticos, tales como los que se encuentran en esta clase de enfermos; y si bién es cierto que se me podría decir que aquí no hay retención de líquidos, tampoco deja de ser cierto que ellos, al caer en la cavidad bucal, son tragados con la saliva y con los alimentos, y una vez absorvidos van á producir los diferentes fenómenos de que he hablado ya. Por qué mecanismo se producen estos accidentes? Bouchard lo ha dicho de una manera magistral en sus lecciones sobre las auto-intoxicaciones, expresándose en los siguientes términos: "El organismo es, en el estado normal como en el patológico, un receptáculo y un laboratorio de venenos; entre estos, unos son formados por el organismo mismo, otros por microbios vejetales inferiores, que son, ó bién los comensales, los habitantes naturales del tubo digestivo, ó bién parásitos advenedizos morbigenos. Así el hombre está constantemente bajo la amenaza de un envenenamiento; trabaja á cada instante en su propia destrucción, hace incesantes tentativas de suicidio por intoxicación y, sinembargo, estas intoxicaciones no siempre se producen. El organismo posee recursos múltiples, para escapar de ellas se descarga de substancias tóxicas en un recipiente particular, de donde salen en seguida al exterior. La sangre por otra parte substrae á los órganos los venenos á medida que se forman.

Como es fácil suponer, lo que se acaba de decir podrá tener lugar en el supuesto de un organismo sano, pero en los enfermos de que me ocupo las cosas no pueden pasar así. Ciertamente, en un sifilítico, el estado general domina todas las funciones; en todas ellas se manifiesta cierta languidez, cierto trastorno, y de consiguiente el funcionamiento orgánico se hace mal, pero principalmente el aparato gastro-intestinal en donde se producirán descomposiciones, putrefacciones, etc.; si á todo esto se reune los productos sépticos venidos de la boca y de la garganta, tendrémos el summum de condiciones favorables para la producción de la auto-infección, la que se revelará por los fenómenos de que he hablado ya, fiebre, sudores, y perturbaciones gastro intestinales, que son todos el resultado de la lucha del organismo para desembarazarse de estos venenos; lucha inútil, pues al fin predomina la acción tóxica, y esto porque el tubo intestinal encargado de eliminar las sustancias nocivas contenidas en el organismo, absorbe al mismo tiempo una parte de ellas que la sangre recoje sin demora, de donde por una parte las deyecciones, por otra los fenómenos de intoxicación, fiebre y sudores.

Así pues, la fiebre en los sifilíticos no es la expresión constante de la infección específica; reconoce, así lo creo, en muchos casos un orígen séptico; los sudores son el resultado de la lucha de las celdillas para desembarazarse de estos productos, y los trastornos gastro-intestinales reconocen la misma causa.

Mas aún, accidentes todavía más graves pueden explicarnos suficientemente el mecanismo de las infecciones que vengo describiendo; quiero referirme al aparato renal, que como es bien sabido, es el eliminador por excelencia así de los venenos venidos de fuera como de los que nacen en el organismo. La integridad perfecta del filtro renal, como se le ha llamado, es una condición esencial de su buen funcionamiento, y desde el momento en que por cualquiera causa falta esa integridad, el organismo tendrá que resentir sus efectos. Muchos casos de muerte repentina son un exacto ejemplo de esta verdad.

Ahora bien, Rayer, el primero, y más tarde Lancereaux, Cornil y otros, han demostrado las afecciones renales en los sifilíticos. Estos autores han encontrado en el periodo secundario la nefritis parenquimatosa ó epitelial, el verdadero mal de Bright sifilítico, la nefritis intersticial en foco, la degeneración amiloide, y en fin, aunque raramente, en el período comunmente llamado segundo-terciario, la goma sifilítica. Todas estas lesiones impidiendo naturalmente la función de los riñones, favorecen la acumulación de productos patógenos en el organismo, produciendo su intoxicación independientemente del virus específico.

A primera vista todas estas cuestiones no parecen merecer toda la importancia que les damos. Sin embargo, si se reflexiona un poco se verá que es absolutamente indispensable conocer á fondo la patogenia de los accidentes de que hablamos, porque si tal enfermo debe ser tratado por el mercurio solo, tal otro tendrá necesidad de una desinfección previa de las lesiones que hayan dado nacimiento á ciertos accidentes de auto-intoxicación. Tan es esto así que el tratamiento debe muchas veces comenzar en ciertos enfermos por la curación de lesiones independientes de la sífilis, tales son los accidentes gastro-intestinales, que como se sabe son una contraindicación para el tratamiento mercurial, pues la integridad de la mucosa del intestino es indispensable para la absorción de las sales de mercurio administradas al interior.

Estando pues probado el papel de ciertas lesiones de la boca y de la faringe en la producción de accidentes graves de auto-infección, el deber del médico queda también perfectamente establecido. Curar estas lesiones antes que los accidentes que ellas producen tengan el tiempo de desarrollarse. Mas para dirigir contra ellas un tratamiento eficaz, el médico debe familiarizarse con estas lesiones, cuyo diagnóstico, si en la mayor parte de los casos es fácil, puede algunas veces presentar muy serias dificultades.

Todos los médicos saben muy bién que una de las primeras manifestaciones del período secundario de la sífilis son las ulceraciones de la garganta, de la lengua y de la boca; pero que las más comunes son las de la región faringea y de preferencia las de las amigdalas, del velo del paladar, y de sus pilares. La región bucofaringea tiene casi exclusivamente el triste privilegio de las placas mucosas. Son casi inevitables en la sífilis, á causa de la irritación constante y forzosa á la cual esta región está expuesta por diversos agentes, tales como el tabaco, el alcohol, y muy principalmente los alimentos, que obran sea por su composición, sea por su acción mecánica. Las placas mucosas así producidas gozan un gran papel en el diagnóstico actual y retrospectivo, como en el tratamiento general de la sífilis.

Muchos sifilíticos, dice Mr. Jullien, suelen escapar de la sífilis grave y de los accidentes terciarios consecutivos, pero se puede asegurar que no hay uno solo que escape de la placa mucosa, de las mucosas; para muchos la sífilis podría reasumirse así: chancro, roseola fugitiva, y á su consecuencia placas mucosas, reincidencia de placas mucosas, y siempre placas mucosas. Mas es preciso distinguir con el mayor cuidado estas ulceraciones verdaderamente sifilíticas de aquellas que no lo son, y que desgraciadamente suelen tomarse con frecuencia como tales, con gran perjuicio del enfermo. Debemos pues diferenciar las ulceraciones que bien pudieramos llamar puras (específicas), y las que son producidas por infecciones secundarias no sifilíticas, y debidas ó á la acumulación de bacterias, ó á irritaciónes, ó en fin á la acción especial del mercurio, que es lo más frecuente y á las que de preferencia quiero referirme.

Las ulceraciones propiamente sifilíticas, las sifílides húmedas, llamadas también placas opalinas, tienen carácteres de tal manera propios que en la mayor parte de los casos, y con un poco de cuidado, es bien fácil reconocerlas. En efecto, su aspecto es característico, y aunque varían un poco según el lugar que ocupan, presentan sinembargo caracteres que les son comunes á todas ellas. Así por ejemplo, la angina sifilítica, se caracteriza por una coloración muy especial, rojo frambuesa, pero que no es como dice muy bien Gueneau de Mussy, el rojo vivo de la escarlatina, tampoco es el rojo dorado de la erisipela, ni el rosa subido de los fumadores, sino un rojo carmin que desde luego llama la atención por su rareza, y cuando se produce la ulceración amigdaliana, esta afecta la forma arredondada como si hubiese sido hecha con sacabocado.

En la región estáfilo-amigdaliana, que como ya he dicho es el sitio de predilección de las placas mucosas, al principo se distinguirían por un engrosamiento circunscrito del epitelio y una especie de despulido, una simple erosión; mas es raro

observarlas en este estado porque generalmente los enfermos no reclaman nuestros cuidados sino cuando han avanzado mucho más, cuando está ya constituida la verdadera ulceración, y entonces se nos presentan con los caracteres siguientes: Son ovalares y no talladas á pico como se cree comunmente, pues la forma alargada é irregular que presentan á primera vista es debida al plegamiento de ellas siguiendo el borde palatino. Su fondo es sucio, cubierto de una escara blanquizca que no se le puede desprender ni con el lavado, es más bien un exudado difteroide; son poco ó nada dolorosas, y el enfermo acusa cuando más una sensación de picoteo y de molestia en el momento de la deglución.

Si la ulceración es más vasta y profunda, su coloración es amarillenta y su aspecto pultaceo, sus bordes engrosados, y entonces si son dolorosas in situ y á distancia, propagándose el dolor á los oidos, y aún no es raro que los ganglios sub-maxilares se infarten.

En cuanto á las ulceraciones de los labios, de las encías y de los carrillos, son más frecuentemente opalinas, y desde el principio se complican de exudaciones difteroides. Si no se les atiende en su marcha, los estragos que producen son considerables, su aspecto se hace exuberante simulando verdaderas vegetaciones.

Ahora bien, las ulceraciones de la boca ó de la garganta que más á menudo son confundidas con las específicas, son las mercuriales; aunque hay otras que producidas por distintas causas presentan cierta analogía con las primeras, tales son por ejemplo, las ulceraciones de los labios y de los carrillos en los vidrieros, la placa mucosa lingual simple, la psoriasis lingual dartrosa, las placas de los fumadores, la estomatitis úlcero-membranosa, y por último el chancro sifilítico mismo; mas de todas estas lesiones las primeras son bien raras, la penúltima es casi propia de la infancia, y la última tiene su bubón que la acompaña fatal y constantemente. Así pues describiré solo las mercuriales, que son en mi concepto las máfrecuentes, las más graves, y las que presentan mayores dificultades para su diagnóstico.

En efecto hay casos en los que más bien por deducción que por convicción se supone su naturaleza, y como una prueba de tan inmensa dificultad citaré aquí textualmente el siguiente hecho tomado de la Clínica Médica de Bennette:

Pour moi, j'en suis convaincu, les sujets dont l'organisme est imprégné de mercure, sont fréquemment affectés d'ulcères que l'on prend tous les jours pour des ulcères syphilitiques. Le cas suivant, dont j'ai été témoin il y a quelques années, est un des premiers qui ont appelé mon attention sur ce sujet. Une petite fille, âgée de 7 ans, venait d'entrer à l'hôpital chirurgical. Elle avait, sur la partie moyenne du tibia, un ulcère arrondi ayant tous les caractères de l'ulcère vénérien, décrit par Hunter. D'après les renseignements recueillis, il paraît que l'enfant avait souffert des dérangements intestinaux, et la mère avait jugé bon d'aller chez un droguiste, demander des poudres purgatives. On lui remit 12 paquets d'une poudre blanche très fine; elle en donnait un le matin et un le soir; au bout de quatre jours survint une salivation abondante; cependant on n'en continua pas moins de donner les poudres restantes, ce qui produisit un état cachectique. Sur ces entrefaites, l'enfant reçut un coup violent sur la jambe, et c'est à la suite de cet accident que se produisit l'ulcère mentionné. Jamais il n'y avait eu de trace de syphilis dans la famille et tous les parents étaient en parfaite santé. Le professeur de clinique, le regretté Syme, déclara publiquement que si cette enfant avait eu dix-sept ans au lieu de sept, trompé par les apparences, il aurait cru à un ulcère syphilitique.[1]

Como se ve, profesores tan eminentes como el clínico inglés citado por Bennette se han encontrado perplejos y embarazados ante el diagnóstico de una ulceración de orígen mercurial, y esto sobre la piel en donde son extremamente raras.

Fácilmente se comprenderá lo que puede suceder cuando tales ulceraciones ocupen sitios de predileción como la boca y la garganta, comunes á las dos variedades, específicas y mercuriales.

[1] Tomo 2º, pág. 669.

Sinembargo, señalaré los caracteres clínicos que he podido observar como distinguiendo esta especie de ulceraciones y que podrán servir en la mayor parte de los casos para diferenciarlas y reconocerlas; comienzan generalmente por un enturbiamiento, digámoslo así, difuso del epitelio, hay desde luego formación de una capa gris sucia que la cubre, no bien circunscrita, muy semejante á la grasa ordinaria, pero que puede desprenderse más ó menos por un lavado antiséptico apropriado. Se nota un inchamiento considerable de la mucosa gingival y faringea, de un color lívido y sangrando fácilmente. Son dolorosas al apretar los dientes ó en el momento de la deglución, producen salivación abundante, y en fin se exacerban bajo la influencia del tratamiento específico, en tanto que las verdaderamente sifilíticas son siempre modificadas favorablemente por el mismo tratamiento.

El exámen microscópico podría también probablemente dar algunos elementos de diagnóstico. Así, en las ulceraciones sifilíticas se encontraría en los puntos donde falta la capa pultacea, además de celdillas pequeñas que forman la base de toda ulceración (leucocitos), las celdillas más grandes características de los procesos sifilíticos, y quizás el bacilo de Lustgarten contenido en ellas. En cambio, en las ulceraciones mercuriales, además de que el exudado que cubre la ulceración no es tan abundante, solo se encontrarían en él las pequeñas celdillas antes citadas.

Por otra parte, raspando una ulceración sifilítica podría obtenerse algunas celdillas con el bacilo de Lustgarten, y en este caso el diagnóstico sería seguro, pero como tales celdillas ocupan habitualmente capas relativamente profundas, no se pueden obtener siempre en cada examen. Por último, no sería imposible encontrar el bacilo mismo libre entre las granulaciones del pus.

Debo á la benevolencia y al talento de mi distinguido compañero y amigo, el Dr. M. Toussaint, un medio de diagnóstico químico que le pertenece, y que es de grande utilidad para reconocer las ulceraciones mercuriales: consiste en recojer la saliva que en abundancia escurre de estas ulceraciones y someterla á las reacciónes del mercurio; con frecuencia se encuentra este metal en exceso.

Tales son los medios que la ciencia ofrece al práctico para reconocer, y por consiguiente, tratar algunas lesiones de importancia en apariencia secundaria, pero de donde nacen por el mecanismo de la auto-infección cierto número de accidentes de una gravedad considerable.

DISCUSSION.

Dr. Ravogli. I am very glad to make a few remarks on the paper of Dr. Garcia, which I find very scientific and of great practical interest. I will limit myself to a few points which have attracted my attention. The existence of a syphilitic fever I am not prepared to deny. I would, however, have that syphilitic fever not mixed with any other fever which may arise in a syphilitic by the reabsorption of the purulent matters from ulcerations. When the syphilitic virus from the lymphatics passes into the system, producing systemic troubles, when the syphilitic erythema appears, then the patient begins to suffer with headache, backache, loss of appetite, feels tired, and loses all his ambition, and in this case some intermittent fever appears. I would not be opposed to calling this fever syphilitic fever, which is nothing else than reaction of the organism to the syphilitic virus. I will not call, however, a syphilitic fever the fever which is sometimes produced by the presence of ulcerations, secondary or tertiary, by the absorption of their purulent and fermentative substances. When the kidneys are concerned, I must say that in the secondary period of syphilis I have very seldom met with kidney derangement. Often I examine the urine of my syphilitic patients, but very seldom find traces

of albumin. Two syphilitic patients in my practice died with parenchymatous nephritis, whose origin I must recognize from syphilis, but syphilis was in the late period. Mercurial ulcerations I have never seen, and all the ulcers, either on the mucous membranes or on the skin, were only the result of syphilis. In the treatment of my patients I am very careful; as soon as that slight sign of stomatitis happens, I stop the administration of mercury. In all the ulcerations with which I had to do I saw always the mercurial treatment act very beneficially. In regard to the disturbances of the gastro-intestinal apparatus, I can say that I very seldom saw them in my practice, and in pretty nearly all my cases the trouble had its origin in the way of administering mercurials. When especially protiodide or biniodide of mercury is given very often stomach catarrh arises, and in these cases on stopping the internal use of mercurial preparations the intestinal and gastric symptoms disappear. I will not, however, exclude the possibility of the presence of ulcerations in the stomach and in the intestines, as we often find ulcerations on the pharynx. The mucous plaques and the ulcerations of the mouth and of the throat must be treated locally, carefully washed and touched, but the general treatment can not be stopped, either in form of subcutaneous injections or by inunctions, as this is the fundamental therapeutic means for their treatment.

Dr. Louis A. Duhring, of Philadelphia. I am not disposed to make remarks upon the paper as a whole, but desire to express my views merely on one point touched on, namely, the influence of the syphilitic virus upon the pathological processes that might occur during the life of the individual. I beileve that this virus may give rise, and in most cases does, to certain distinct so-called syphilitic manifestations in the various tissues of the body, but that in some other cases it influences, in a variable measure, other pathological processes which may exist, especially those of a chronic nature. In this case it becomes a question which process is the more active and virulent on the body. One generally predominates and holds the other in submission, at least for a time. The complications which syphilis may give rise to are not thoroughly appreciated in the works on medicine, whether general or special. We must recognize the fact that so-called "mixed diseases" may and sometimes do occur. They constitute some of the "unclassifiable cases" that we occasionally meet with.

Dr. Rake. I have seen several cases of syphilis associated with leprosy, and have often had great difficulty in determining to which disease the various lesions met with were due. In autopsies I have sometimes found the lesions of the two diseases side by side. I have seen syphilitic degenerations in the viscera, together with leprous deposits in the larynx. On the other hand, I have in some cases had great difficulty in deciding whether caries of the nasal bones and destruction of the epiglottis are due to syphilis or to the leprous processes which we know occur in these tissues. During life I have seen gummata develop in a leper and clear up in a short time, under mercury and iodide, while the course of the leprosy has been unaffected. It would thus appear that sometimes one disease may be unaffected by the other, while in other cases the lesions of leprosy, and those of syphilis become almost hopelessly mixed. We of course remember that it was formerly believed that leprosy was a form of syphilis, but this theory has long been entirely abandoned.

Dr. Welch. I am led by the discussion to make but a single remark, which is that the existence of syphilis, so far as my experience goes, does not exert any influence over smallpox. What it may do in chronic disease I can not say, but I have frequently seen syphilis, in some one of its three stages, exist in smallpox patients without the one disease, so far as I could see, changing to any degree the course of the other.

Dr. Ohmann-Dumesnil. I have seen syphilis modify other diseases. As Dr. Duhring remarked, it is the chronic manifestations which are thus influenced. I

have seen a chronic eczema of many years' standing disappear after the evolution of syphilis. I have also seen psoriasis disappear, a conclusion which was rather unexpected in view of the fact that squamous syphilides are so prone to occur. On the other hand, the syphilitic process produces lesions, non-specific in character, although marked, and requiring treatment non-specific in character.

Dr. GARCIA. The points more interesting in my paper are lésion gutturale de la langue, etc., produced by the mucous plaques, or by any other irritant, tobacco smoking, or by the nutritive substances, or from the abuse of mercury, producing virulent fluids, which are swallowed into the stomach, and when they are absorbed they produce an auto-intoxication, the symptoms of which are the diarrhœa, loss of appetite, etc., and then the fever, which is not the manifestation of the syphilis, but a reaction of the system to get rid of these poisonous substances.

Dr. G. CLOTURE. I do not believe that the fever to which Dr. Ravogli has called attention has anything to do with the fever to which I call attention. We have more important diseases of the skin where no fever exists. In the patients of which I speak no dermatosis is present, they are getting pale, they have fever at night, etc., and when we look in the mouth or on the throat we find mucous plaques, from which a great quantity of purulent matter comes. For these patients let the mercury alone and use asepsis of the mouth and of the throat, and in a few hours we will see an improvement. In renal affections, Ravogli says that he has not found albumin in the urine. I think that is true, as the albumin does not appear on account of the mercurial treatment; but diseases of the kidneys have been found at the autopsy. These diseases have been developed by the syphilitic process. Syphilis does not always produce syphilitic lesions. In cases of pneumonia, syphilis stops until the acute disease is finished; the same in cases of trauma. During the process of smallpox syphilis stops, and the acute disease continues its course. It is difficult to make the differential diagnosis between the mercurial ulcerations and the syphilitic ones. The syphilitic ulcers are sharply cut. The mercurial ulcerations are of the same aspect. The syphilitic ulcerations are dull red; the mercurial ulceration is covered with a diphtheroid mass which is easily detached. In the syphilitic ulcers Lustgarten bacilli are found, and not in the mercurial.

A CASE OF INTERMITTENT PRURITUS.

By A. H. OHMANN-DUMESNIL, of St. Louis.

Pruritus is one of the neurotic disturbances of the skin which has never lost interest for the student of cutaneous disorders. As it is embraced in the great class of diseases whose symptoms are entirely symptomatic and whose etiological factors have a greater or less obscurity clouding them we are more or less attracted to their further study, and this is one of the chief reasons why I desire to place on record a case which is unique in my experience and of which I have not seen a similar record in my reading. To begin with, I will first detail the case, reserving any observations for further discussion to a later time. I desire to premise that the patient is still a resident in my city and is occasionally seen and that at latest accounts the condition which I am about to describe remains unaltered, although it is but just to remark that no treatment whatever has been attempted up to the present:

Mrs. W. is a woman of medium height, who is well nourished. She has a good suit of brown hair, that on the pubes and in the axillæ being also of good growth. She is 29 years of age. Her menstruation was always normal and regular previous to her marriage, which took place when she was 16 years old. When 17 years of age she bore a child, which is now 12 years of age. At this time (that of delivery) she experienced quite an extensive laceration of the cervix uteri. A series of domestic troubles culminated in her taking 4 ounces of tincture of opium on March 6, 1889. Through the strenuous efforts of the physicians called in to treat her she was saved, and her next menstrual period occurred on April 16 of the same year. It is from this time that her present trouble dates. She has been observed in her attacks, and they all resemble each other. Before, during, or immediately after menstruation she is the subject of an intense pruritus, which attacks the entire integumentary surface. The itching is equally severe everywhere, and no amount of scratching will relieve it. An attack will continue for twenty-four to thirty-six hours, although at first the duration was three days. Among the peculiarities observed during an attack is that the face assumes an intense red color, and in addition to this the pupils contract to one-third the normal size. Another peculiarity is that the most violent scratching produces no lesions whatever. It sometimes happens that an attack of the trouble is missed, yet the patient will continue to menstruate normally at regular periods. Not long since (July, 1893) she was successfully operated upon for her laceration, but the attacks of pruritus have recurred since. This patient has never taken opium nor any narcotic since the poisonous dose referred to above, and she was not addicted to their use prior to that event. In fact, she has never taken medicine of any kind at any time unless it be a little extract of peppermint or a mild saline cathartic. A fact which has been observed is that the attacks grow milder every year, despite the circumstance that she has never been treated for the trouble. This woman is peculiarly nervous in disposition. She is restless, and when awake has a habit of tearing paper into small pieces, and has in general destructive impulses of a mild character. She is of a passionate disposition, and the sexual orgasm is of an intense character in her case. She is also inclined in a great degree to erotomania, being upon the very verge of being an erotomaniac, although not suffering from nymphomania.

This case offers some peculiarities which to my mind are not easy of solution. The etiological factors are far from being clearly defined. The pruritus can not be said to depend upon any uterine disorder, for it did not occur before to the date of the opium poisoning. On the other hand, the ingestion of the narcotic cannot be directly called upon as a factor in the production of the itching. Whilst we know that opium and some of its alkaloids produce pruritus, this subjective trouble disappears upon the cessation of the action of the medicament. Of course it may be said that the ingestion of such a large quantity of opium produced a certain effect upon the nerve centers and that this was perpetuated, but it is merely restating facts as they exist. The regularity of the appearance of these attacks, with a possible few exceptions, is analogous to some other conditions which have been observed in connection with certain cutaneous affections, notably recurrent

exfoliative erythema, or closely resembling the recurrent attacks at regular intervals which are observed in certain diseases which are supposed to be of nervous origin, such as hay fever, epilepsy, etc. The fundamental cause of this periodical recurrence has never been definitely ascertained, and I must perforce be satisfied in simply recording an interesting condition and confess my inability to account for it in any manner which would be either adequate or satisfactory.

DISCUSSION.

Dr. POLLITZER, of New York. I should merely like to lay some stress on the fact that the case described by the author of the paper belongs to the class of reflex neuroses connected with the menstrual function. I have in mind the herpes progenitalis and H. labialis, which recurs sometimes regularly with each menstrual epoch. I have known a case in which herpes labialis recurred for a period of nearly two years, during which the patient was under observation every four weeks, at the end of the catemenia. Reflex neurosis associated with menstruation and pregnancy are not at all uncommon, though the case of the author is well worth recording and is in some respects unique.

Dr. OHMANN-DUMESNIL. Dr. Duhring does not regard the case as unusual, because it is known that nervous troubles occur at this time. Yet cases of this sort have not been reported. So far as secondary lesions are concerned, I have frequently seen them follow pruritus of the anus, and many cases also did not show any marks. But in the case which I have detailed there was evidently some trouble at the base of the brain, as evidenced by the flushing of the face and contraction of the pupil.

A STATISTICAL RECORD OF 5,000 CASES OF SMALLPOX.

By WILLIAM M. WELCH, M. D.,

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Recognizing the difficulty of interesting an audience by the narration of statistics simply, I have concluded to present the facts which I have to offer somewhat after the style of an object lesson. I shall mention but few facts that can not be seen clearly illustrated in the tables hanging before you. Before calling your attention to these tables I should say that the opportunity to study and classify these 5,000 cases of smallpox was afforded me in the Municipal Hospital for Infectious Diseases, of Philadelphia, during the period from 1870 until the early part of the present year. This period includes several epidemics of the disease, some of which were of considerable magnitude and great virulence—notably, the epidemic of 1871-'72, which was almost world-wide and everywhere marked by unusual malignancy. During such visitations of the disease a very large proportion of the severe and malignant cases were found among the admissions to the hospital. This is owing to two facts: First, since removal of patients to the hospital was not compulsory, most of the milder cases were treated at their homes; and, secondly, that a very large proportion of the patients were received from the lower class of society, with constitutions exhausted or depraved by intemperance and other depressing habits. Even many of these were not received until all hope of recovery had passed. During the epidemic of 1871-'72 as many as 128 patients died in

less than forty-eight hours after admission, while, indeed, a few others died in the ambulance on their way to the hospital, and all such are, of course, included in the statistics to be submitted. I mention these facts in explanation of the unusually high death rates to be seen in the tables. But while the death rates are unusually high there is no disproportion in this respect between the vaccinated and the unvaccinated cases. That is to say, if the death rate is excessively high in the one, it is to an equal degree excessively high in the other. There will, therefore, be no difficulty in measuring by these statistics the value of vaccination as a protective or modifying agent in smallpox. The first table to which I shall call attention is one showing the cases classified accordingly as the disease was unmodified or modified. The former type, of course, is designated variola, and the latter, varioloid, while the term smallpox, whenever used, must be understood as including both.

TABLE 1.—*Showing the cases divided into variola and varioloid.*

Disease.	Admitted.	Died.	Per cent of deaths.
Variola	2,831	1,534	54.18
Varioloid	2,169	28	1.29
Total	5,000	1,562	31.24

All unvaccinated cases, all malignant cases, and all vaccinated cases in which the eruption advanced to the pustular stage and was attended by well-marked secondary or suppurative fever have been classified in this table as variola; while all the vaccinated cases in which the eruption was markedly abridged in its course, and in which there was little or no secondary rise of temperature, have been classified as varioloid. According to this classification a fatal result almost never occurs from the latter, except in greatly enfeebled constitutions or when some complication arises. While the death rate was 54.18 per cent from variola, it was only 1.29 per cent from varioloid.

TABLE 2.—*Showing the cases classified according to the sex of the patients.*

Sex.	Admitted.	Died.	Per cent of deaths.
Male	3,261	1,031	31.61
Female	1,739	531	30.54
Total	5,000	1,562	31.24

The table shows that a considerably larger number of males than females was admitted to the hospital, and also that there is practically no difference between the death rates of the two sexes. Although the preponderance of cases is on the side of males, yet it can not be said that sex exerts any influence whatsoever over susceptibility to smallpox, nor that the disease, all things being equal, is more fatal among one than the other. It is true that men are more frequently addicted to intemperance, and that this habit predisposes to malignancy of the disease; but, on the other hand, pregnancy in women is very liable to be followed by abortion, and when this accident occurs it always proves to be a very serious complication.

TABLE 3.—*Showing all the cases classified according to the color of the patients.*

Color.	Admitted.	Died.	Per cent of deaths.
White	4,200	1,221	29.07
Black	800	341	42.62
Total	5,000	1,562	31.24

It is generally believed that smallpox is more fatal among colored persons than among whites, and the above table seems really to support such a belief, but before a reliable conclusion can be arrived at it is necessary that the patients of both colors should be observed under precisely the same circumstances; that is to say, comparison should be made between the unvaccinated of each color. Such a comparison may be seen in the following table:

TABLE 4.—*Showing the unvaccinated cases of smallpox classified according to the color of the patients.*

Unvaccinated.	Admitted.	Died.	Per cent of deaths.
White	1,173	681	58.05
Black	439	257	58.54
Total	1,612	938	58.18

Reference to the last two tables shows that of the two classes of patients, white and black, a very much larger proportion of the blacks were unvaccinated. Of course that accounts for the greater percentage of deaths among this class in the former table. In the latter table, however, where a comparison can be made between the unvaccinated of each color, it is seen that there is practically no difference in the death rates, the deaths among the whites being at the rate of 58.05 per cent and among the blacks 58.54 per cent. I would not presume to say that all the observers who contend that smallpox is more fatal among negroes than whites are mistaken in regard to their observations, but I wish to emphasize what I have already said, that no conclusion on this point is reliable unless both of these classes of patients have been observed under precisely the same circumstances.

TABLE 5.—*Showing the cases classified according to the vaccine condition of the patients.*

	Admitted.	Died.	Per cent of deaths
Vaccinated in infancy, good cicatrices	1,412	124	8.78
Vaccinated in infancy, fair cicatrices	666	98	14.71
Vaccinated in infancy, poor cicatrices	1,070	290	27.10
Post-vaccinal cases	3,148	512	16.26
Unvaccinated cases	1,759	1,027	58.38
Unclassified cases	93	23	24.73
Total	5,000	1,562	31.24

In this table a comparison may be made between the vaccinated and the unvaccinated cases. For reasons already stated, the proportion of deaths in both cases is excessively high. Among the unvaccinated it is as high as 58.38 per cent, and among the vaccinated, as a whole, 16.26 per cent. Although high, the difference between these death rates is very striking. If the 1,759 unvac-

cinated cases had been vaccinated in infancy similar to the others, instead of 1,027 deaths among this class, there would have been only 286, a saving of 738 lives. Vaccination would have accomplished even more than this for these patients; it would have so modified the disease in a large proportion of those that recovered as to have preserved them from disfigurement for life.

In examining the cicatrices of a large number of persons it is found that these scars differ considerably in appearance, and the question naturally arises, can protection be measured to any degree by the different characteristics which they present? There is no doubt that many persons with quite inferior vaccine marks are fairly well protected or even enjoy immunity from smallpox, while many with typical marks prove to be susceptible to the disease, and indeed often perish from it. But such results must, I feel sure, be regarded as exceptions to the rule. When a large number of patients are examined and the results tabulated, as the above table shows, the degree of protection, as indicated by the death rates, is found to bear a very close and direct relation to the character of the vaccine cicatrices.

All of the patients represented in the tables were carefully examined on their admission to the hospital, and the number and character of their vaccine scars at once recorded. At this time it was of course generally impossible to foretell the final result. The scars were divided, according to their quality, into three grades, which are designated in the tables by the terms "good," "fair," and "poor." Under the first head I have classified all cases presenting typical vaccine cicatrices; that is to say, cicatrices which are distinctly excavated, with well-defined margins, reticulated or foveolated, and altogether presenting the appearance of having been stamped into the skin by a sharply cut die. Under the second head I have classified all cases with scars having the same general characteristics, though much less distinctly marked. Under the third head have been classified all cases having scars which were said to have been the result of vaccination, but which in very many instances were so indistinct or uncharacteristic as to make it difficult, and sometimes even impossible, to recognize them as vaccine scars. The cases classified under the heads of both "good" and "fair" marks had all, doubtless, passed through a well-marked, or reasonably well-marked, course of vaccina in infancy. The death rates are respectively 8.78 and 14.71 per cent. But I am strongly of the opinion that very many of the cases classified under the head of "poor cicatrices" were never successfully vaccinated. Very often I felt fully convinced at the time of making the examination and recording the vaccine condition that such was the case, but as the patients insisted that they had been vaccinated I could not reject their testimony without being considered, especially by the enemies of vaccination, a partial judge. It certainly does not detract from the reputation of vaccination to know that when the vaccine process is irregular, imperfect, or spurious the protection is diminished or absent. As the mean death rate of the cases showing "good" and "fair" cicatrices is 10.68 per cent, and the death rate of those showing "poor" scars is 27.10 per cent, it is evident that not only very many of the latter had been imperfectly vaccinated, but that a large number had never been subjected at all to the vaccine process.

It is impossible to illustrate in this table the very striking and conclusive evidence of the protective power of vaccination that frequently came under my notice while observing these 5,000 cases of smallpox. Such, for instance, as witnessing on the one hand an unvaccinated person suffering from the confluent form of the disease, loathsome and offensive, with the final issue for several days uncertain, and on the other hand a vaccinated person undergoing a modified form of the disease so mild and innocent in its character as not to excite any apprehension for the safety of the patient. In the former case, if recovery took place, the individual was left disfigured for life, while in the latter, after a few months

had passed, there was but little, if anything, in the appearance of the individual to indicate that he had ever suffered from the disease at all. Also, I have seen over and over again entire families brought into the hospital when all the unvaccinated children have been suffering from smallpox and the vaccinated children unaffected; have seen the former perish and the latter remain exempt from the disease, although living, eating, and sleeping in the infected atmosphere for several weeks; but I have yet to see a single unvaccinated child escape the disease under similar circumstances. Furthermore, I have more than once seen a vaccinated infant draw its daily supply of nourishment from a mother suffering from varioloid and the infant remain as free from any symptom of the disease as if the infection were a thousand miles away and the food were received from a most wholesome source. All this is evidence of the prophylactic power of vaccination that can not be seen in mortality tables.

Under the head of "unclassified cases" in the last table are included quite a large number of patients who were vaccinated after exposure to the variolous infection, and also a few patients who died and were buried before an examination as to their vaccine condition could be made.

The next table to which I shall direct attention is one illustrating the comparative efficacy of vaccination as performed in various countries, especially in the United States, Germany, and Ireland.

TABLE 6.—*Showing the cases classified as to nationality of the patients and their vaccine condition.*

	Admitted.	Died.	Per cent.
UNITED STATES.			
Not vaccinated	1,457	831	57.03
Vaccinated in infancy:			
Good mark	686	53	7.72
Fair mark	375	53	14.13
Poor mark	594	168	28.52
Post-vaccinal cases	1,655	274	16.49
GERMANY.			
Not vaccinated	59	34	57.62
Vaccinated in infancy:			
Good mark	345	33	9.56
Fair mark	157	19	12.10
Poor mark	250	47	18.80
Post-vaccinal cases	752	99	13.16
IRELAND.			
Not vaccinated	168	112	66.66
Vaccinated in infancy:			
Good mark	212	18	8.49
Fair mark	57	15	26.31
Poor mark	130	53	40.76
Post-vaccinal cases	399	86	21.55
OTHER NATIVITY.			
Not vaccinated	64	41	64.06
Vaccinated in infancy:			
Good mark	164	18	10.97
Fair mark	75	10	13.33
Poor mark	95	21	22.10
Post-vaccinal cases	334	49	14.67
UNKNOWN.			
Not vaccinated	11	9	81.81
Vaccinated in infancy:			
Good mark	5	2	40.00
Fair mark	2	1	50.00
Poor mark	1	1	100.00
Post-vaccinal cases	8	4	50.00

Perhaps I should explain, in the first place, that the high rate of mortality exhibited under the head of "unknown" nativity is owing to the fact that many of the patients therein represented were foreigners apparently, and were received into the hospital in a moribund state, so that it was impossible to learn their nationality. I may add, also, that under the heading of "other nativity" are included the patients who were natives of the various countries of the globe not designated in the table, excepting China and Japan. Referring to the table, it is seen that under the three nationalities given the death rates of the unvaccinated cases of the United States and Germany do not differ materially, but the death rate of the unvaccinated cases of Ireland is very much higher. A comparison of the post-vaccinal cases also shows that the vaccinated patients of Irish birth have perished in the largest proportion. This seems to indicate that smallpox is most fatal among the Irish; a fact which I believe I have noticed in every epidemic of the disease that I have witnessed. The difference between the rates of mortality among the cases showing "good" marks, as is seen under the three nationalities mentioned, is not great, and the slight difference that does exist may be entirely accidental. But the difference between the death rates of those showing "poor" marks is very great, and decidedly in favor of the patients of German birth. The vaccinations performed in Germany prove to be more uniformly protective, and hence the death rate among the post-vaccinal cases under this head is the lowest of any of the nationalities. All this seems to prove that vaccination is most efficaciously performed in Germany. The comparative exemption of Germany and the German army from smallpox is simply a striking example of the brilliant result of careful and efficient vaccination. When most of the vaccinations represented in the table were performed it was customary in the United States, and in Ireland also, I believe, to use humanized crusts; but in Germany fresh eight-day lymph or arm-to-arm vaccination was the means or method employed, and this is calculated to give the very best results. Hence I think it is not improbable that the German patients owe their better protection to the superior quality of the vaccine lymph generally employed in their country. There is another explanation that might be offered to account for the superior protection enjoyed by the German patients, namely, that it is the practice in Germany in performing vaccination to make numerous insertions of the vaccine virus. In examining the arms of German patients it is quite common to find three distinct scars on each arm, and even a greater number is frequently met with. I have seen as many as twenty typical vaccine marks on the arms of a German patient. If multiple insertions of the vaccine lymph increase the protection against smallpox—and statistics are not wanting to show that such is the case—surely German subjects should be well protected. But, in view of the facts which will appear in the following table, I am inclined to believe that the Germans owe their superior protection from smallpox more to the quality of the vaccine virus they use than to the number of insertions they make.

TABLE 7.—*Showing the cases classified as to the number and character of the vaccine scars borne by each patient.*

	Admitted.	Died.	Per cent.
Not vaccinated	1,512	881	58.26
Claiming to have been vaccinated but no visible mark*	247	146	59.10
Vaccinated 7 days and less prior to the appearance of the variolous eruption	57	25	43.86
Vaccinated longer than 7 days prior to the appearance of the variolous eruption	74	15	20.27
Vaccinated in infancy:			
One good mark	787	70	8.89
One fair mark	430	67	15.58
One poor mark	850	252	29.64
Total	2,067	389	18.81
Vaccinated in infancy:			
Two good marks	265	20	7.54
Two fair marks	105	14	13.33
Two poor marks	94	22	23.40
Total	464	56	12.06
Vaccinated in infancy:			
Three good marks	119	10	8.40
Three fair marks	45	4	8.88
Three poor marks	49	13	26.53
Total	213	27	12.67
Vaccinated in infancy:			
Four or more good marks	247	24	9.74
Four or more fair marks	80	10	12.50
Four or more poor marks	97	11	11.34
Total	424	45	10.61

* The cases classified in this table as claiming to have been vaccinated, but showing no visible mark, are included in the other tables among the unvaccinated. So, also, quite a number of those classified in this table as having been vaccinated during the incubation period of smallpox are included among the vaccinated or unvaccinated in some other tables, which fact will explain some discrepancies.

The first thing to be seen in this table is that there is practically no difference between the death rates of the unvaccinated patients and those claiming to have been vaccinated but showing no visible mark. This proves that there was either a mistake as to the alleged fact, or that a vaccination which is followed by no mark is devoid of protective power. The table also shows that vaccination practiced after exposure to the infection of smallpox may afford considerable protection against the disease. If it be performed within two or three days after the infection has been received into the system it is possible for the protection to be absolute. I have seen as many as 28 children perfectly protected from smallpox by vaccination during the incubation period.[1] But if the vaccination be performed much less than seven days before the eruption of smallpox appears, no modifying influence will be exerted. A considerable number of the cases included in the above table under the head of "vaccinated seven days and less, prior to the appearance of the variolous eruption," had been vaccinated no longer than from two to four days before the eruption appeared, while a somewhat larger number had been vaccinated as long as from four to seven days before it appeared. Taking the whole number of cases under this head, it is seen that the death rate is 43.86 per cent, while among the unvaccinated it is as high as 58.18 per cent. This shows that considerable protective influence must have been exerted by vaccination performed

[1] For further information on this subject, see my paper on "Vaccination During the Incubation Period of Variola," published in the Transactions of the Ninth International Medical Congress, Vol. IV, p. 160.

during that period. But a still greater influence was exerted among the cases included under the succeeding head, where vaccination is represented as having been performed longer than seven days before the smallpox eruption appeared. The death rate here is only 20.27 per cent. In regard to the matter of estimating the efficacy of vaccination by the number of vaccine cicatrices borne by each person, the table can not be said to support the views of most authors, nor does it accord with the experience of some other observers. It is indeed in striking contrast with the evidence on this point collected by Mr. Marson and tabulated by Mr. Simon. According to these authors, who derived their data from 6.000 post-vaccinal cases of smallpox, the mortality rate among patients having 1 vaccine scar was 7½ per cent; having 2, 4½ per cent; having 3, 1¾ per cent; having 4 or more, three-fourths of 1 per cent. Where the vaccine scars were all well-marked or typical, the loss by death is said to have been even less than is here indicated. The table shows, it is true, that the highest death rate is among the patients having but 1 vaccine mark, but unquestionably this is owing to the fact that a very much larger proportion of the patients under this head than under any other showed "poor" marks, and, as already pointed out, very many of these patients would be more correctly classified if counted among the unvaccinated cases. Those having 4 or more "poor" marks are in a much smaller ratio to the total number of post-vaccinal cases under that head than under any other, and the death rate, to be sure, is remarkably low. It is indeed almost as low as among those showing 4 or more "good" marks. The explanation of the low death rate here is that nearly all the patients classified under this head were natives of Germany, where, as already shown, vaccination is so efficiently performed that if the scars are not in every respect typical there is nevertheless well-marked protection.

Referring again to the table, it is seen that where the vaccine scars are typical there is no relation between the number of such scars and the degree of protection conferred against smallpox. Indeed, it so happens in the table that the death rate among the patients having but one "good" mark is a little lower than among those having 4 or more "good" marks. There is no doubt that vaccine, characterized by a single typical vesicle, destroys in the individual all susceptibility to smallpox, and it would be impossible for multiple vesicles to do more than that. As a safeguard against failure, however, or when using long-humanized virus, it is advisable to make several insertions; but I must repeat that it is my positive conviction that the quality of vaccine lymph has far more to do with securing efficient vaccination than have multiple insertions.

In the next table is illustrated, first, the efficacy of recent vaccination, as performed in infancy, and, secondly, the gradual loss of vaccine protection as the individual grows older.

TABLE 8.—*Showing the cases classified as to age periods of the patients, and also as to their vaccine condition in each period.*

Ages.	Admitted.	Died.	Per cent of deaths.
Under 1 year:			
Unvaccinated	78	57	73.07
Vaccinated	2		
1 to 7 years:			
Unvaccinated	404	208	51.48
Vaccinated in infancy—			
Good mark	10		
Fair mark	10	1	10
Poor mark	15	1	6.66
Total number vaccinated	35	2	5.70
7 to 14 years:			
Unvaccinated	222	71	31.98
Vaccinated in infancy—			
Good mark	55	2	3.63
Fair mark	23	2	8.69
Poor mark	59	9	15.25
Total number vaccinated	137	13	9.48
14 years and upward:			
Unvaccinated	1,038	681	65.60
Vaccinated in infancy—			
Good mark	1,344	122	9.07
Fair mark	629	93	14.78
Poor mark	994	280	28.16
Total number vaccinated	2,967	495	16.68

It can not be questioned that in a large city like Philadelphia, where gratuitous vaccination is provided for the poor and improvident class of the community, there must be a very much larger number of children under 1 year old vaccinated than unvaccinated, and yet it is seen by the table that 78 of the latter were admitted to the hospital and only 2 of the former. The unvaccinated perished in the proportion of 73.07 per cent, while both of the vaccinated cases of course recovered. One of the vaccinated children was 11 months old, had been vaccinated two months previously, showed a good cicatrix, had varioloid in an exceedingly mild form, the eruption consisting of only six small vesicles, and the child was at no time ill. The other vaccinated case had the disease so indistinctly marked that following the diagnosis of varioloid, as recorded in the record book, I find a mark of interrogation. These facts show that smallpox among unvaccinated children under 1 year old is very common and fatal, and that among vaccinated children at this age it is very rare, and when it occurs at all it is no more to be feared, so far as danger to life is concerned, than ordinary vaccina.

In children between the ages of 1 and 7 years smallpox is, of course, very common among the unvaccinated, and occasionally it is seen in a very mild form among the vaccinated; but death never results where there is evidence of thorough vaccination, except occasionally from some complication. It is seen in the table that one death occurred under the head of "fair" vaccine mark. In this case the child was about 1 year old, a foundling, badly nourished, having disordered digestion, and was very feeble. The eruption consisted of only a very few small vesicles. Death resulted from sheer debility. Very little need be said of those classified under the head of "poor" vaccine scars, as the vaccination in all such cases was either imperfect or spurious. In the next age period, 7 to 14 years, it is worthy of note that the death rate among the unvaccinated cases is very much lower than at any of the other age periods. Possibly the explanation of this is that the

recuperative powers of life are most active at that age, or that some of the depressing habits common in later life, such as intemperance and the like, have not yet been formed. At this period of life post-vaccinal cases of smallpox increase considerably, and occasionally death occurs from the disease, even after quite thorough infantile vaccination. These facts clearly indicate that the vaccination of infancy is apt to lose at this period more or less of its protective power.

The last age period noted in the table, 14 years and upward, illustrates, in in the first place, how large is the number of youths and adults who have never enjoyed the prophylactic power of vaccination. Among this class, too, the death rate is seen to be considerably higher than that of the corresponding class in either of the two preceding age periods. The table also proves in a very indubitable manner, by the great increase of post-vaccinal cases of smallpox at this age period, that vaccination in infancy can not be depended upon to confer protection against the disease in the later life of the individual. There are, therefore, two important facts prominently brought forward in this table: First, that recent vaccination confers absolute, or almost absolute, protection against smallpox; and, secondly, that when vaccination has been performed in infancy revaccination is required at, if not before, the age of puberty.

My experience leads me to place implicit confidence in the efficacy of revaccination, although the statistics presented in the following table are somewhat vague and indefinite and do not fully nor clearly demonstrate the real merits of the measure. The table simply contains the relevant data as obtained from the patients who claimed to have been vaccinated in infancy and subsequently revaccinated, together with the general results.

TABLE 9.—*Showing the cases occurring in patients after alleged revaccination.*

No.	Age.	Character of marks from vaccination in infancy.	Character of marks from the alleged revaccination.	Length of time since the alleged revaccination.	Disease.	Result.	Number of days in hospital.	Remarks.
	Years.							
1	45	Poor	Doubtful	31 yrs	Varioloid	Recovery	23	
2	23	Poor	Fair	6 to 8 yrs	do	do	7	Eruption very light, mostly papular; patient not confined to bed.
3	65	Poor	Poor	24 yrs	do	do	8	Disease very mild.
4	34	Fair	Doubtful	9 yrs	Confluent variola.	do	77	
5	23	Poor	do	13 yrs	Varioloid	do	7	
6	20	Poor	do	4 wks	Variola	Death	14	
7	21	Poor	do	11 yrs	Varioloid	Recovery	19	
8	27	Fair	Fair	8 yrs	Variola	do	28	
9	20	Good	Good	10 yrs	Varioloid	do	6	Disease very mild.
10	23	Good	Poor	Since puberty	do	do	19	Eruption consists of about six vesicles.
11	24	Fair	Doubtful	3 mos	Variola	do	19	
12	19	Poor	Very poor	4 wks	Varioloid?	do	4	Eruption only papular, disappearing in two or three days.
13	20	Good	Invisible	2½ yrs	Variola	Death	4	Does not give a very intelligent account of revaccination; case hemorrhagic.
14	26	Good	Good	14 yrs	Varioloid	Recovery	7	Eruption very light; only slightly vesicular.
15	23	Poor	Invisible	10 yrs	do	do	24	
16	26	Good	Good	2 mos	Varioloid?	do	2	The variolous eruption so mild as to be of a doubtful character.
17	22	Poor	Fair	7 yrs	Varioloid	do	7	Eruption very mild; three months pregnant; abortion threatened but did not occur while in hospital.
18	24	Good	Poor	9 yrs	Varioloid?	do	21	Eruption so mild as to be of doubtful character.
19	35	Poor	Invisible	21 yrs	Varioloid	do	11	
20	37	Fair	Fair	21 yrs	do	do	21	
21	20	Good	Poor	1 mo	do	do	9	Eruption very light.
22	44	Good	Poor	6 yrs	do	do	14	
23	24	Fair	Poor	6 wks	do	do	11	
24	17	Good	Poor	4 mos	do	do	15	
25	24	Good	Poor	2 mos	do	do	11	
26	17	Fair	Fair	3 mos	do	do	9	
27	29	Fair	Fair	6 mos	do	do	26	Eruption consists of only a few papules, which did not become vesicular
28	18	Good	Scarcely visible.	do	Variola	do	33	
29	35	Poor	Uncertain	16 yrs	Varioloid	do	26	All marks have the appearance as if from primary vaccination.
30	32	Fair	Invisible	5 yrs	Variola	do	51	
31	35	Good	Fair	2½ yrs	Varioloid	do	18	Says was exposed to the infection of smallpox shortly after revaccination was performed, but did not take the disease then.
32	24	Good	Invisible	7 yrs	Variola	Death	1	Claims to have been revaccinated at 17 years of age, but no scar resulted.
33	24	Good	Fair	8 yrs	Varioloid	Recovery	10	Disease very mild.
34	26	Good	Poor	4 yrs	do	do	20	
35	48	Poor	Poor	14 yrs	do	do	23	

36	30	Fair	Fair	14 yrs	Variola	do	64	
37	19	Good	Poor	5 yrs	Varioloid	do	19	
38	40	Good	Poor	13 yrs	do	do	7	
39	44	Poor	Poor	15 yrs	do	do	11	
40	36	Good	Good	14 yrs	do	do	19	
41	34	Poor	Poor	18 mos	do	do	19	Eruption very light.
42	36	Good	Fair	3½ yrs	do	do	19	Do.
43	58	Poor	Not characteristic.	16 yrs	do	do	16	
44	24	Fair	Poor	14 yrs	do	do	14	
45	16	Very poor	Very poor	1 yr	do	do	14	Do.
46	57	Fair	Poor	37 yrs	do	do	12	Do.
47	19	Poor	Not characteristic.	2 yrs	do	do	10	
48	23	Good	do	17 yrs	Variola	Death	18	Case hæmorrhagic; complicated also by disease of brain.
49	25	Poor	Poor	9 yrs	do	do	8	Eruption confluent.
50	40	Invisible	Poor	17 yrs	do	do	15	Eruption confluent; gangrenous inflammation of right arm.
51	33	Poor	Invisible	9 yrs	Varioloid	Recovery	16	Eruption very light.
52	19	Poor	Good	9 yrs	Variola	do	69	
53	23	Good	Fair	10 mos	Varioloid	do	9	Very mild case.
54	35	Very poor	Very poor	6 yrs	Variola	Death	6	Eruption confluent and flat.
55	46	Good	Fair	19 yrs	Varioloid	Recovery	21	
56	46	Very poor	Very poor	18 yrs	do	Death	3	Suffering also from chancre.
57	56	Poor	Poor	4 yrs	do	Recovery	22	
58	27	Invisible	Good	12 yrs	do	do	20	
59	54	Very poor	Doubtful	32 yrs	do	do	38	
60	25	Fair	Poor	13 yrs	do	do	13	
61	35	Good	Very poor	10 yrs	do	do	18	
62	38	Very poor	Poor	8 yrs	do	do	26	
63	26	Good	Not recorded	16 yrs	do	do	11	Eruption consists of about twelve vesicles, which are scarcely characteristic.
64	35	Fair	Not characteristic.	19 yrs	Variola	Death	6	Hæmorrhagic tendency.
65	40	Indistinct	Indistinct	9 yrs	Varioloid	Recovery	17	Disease very mild.
66	36	Good	Poor	18 yrs	Variola	Death	11	Eruption intensely confluent.
67	38	Fair	Very poor	10 yrs	Varioloid	Recovery	42	Two months pregnant.
68	30	Poor	Poor	2 yrs	do	do	12	
69	48	Good	Good	22 yrs	do	do	32	
70	40	Good	Fair	31 yrs	do	do	26	
71	22	Poor	Fair	4 yrs	do	do	15	
72	26	Good	Poor	9 yrs	do	do	7	Disease very mild.
73	45	Poor	Poor	5 or 6 yrs	do	do	41	Says was vaccinated when an infant and again at five or six years of age, but does not know which scar belongs to the former nor which to the latter.
74	29	Good	Very poor	5 or 6 yrs	do	do	19	Says the revaccination "took" only slightly.
75	40	Good	Good	4 yrs	do	do	92	
76	53	Fair	Poor	7 yrs	do	do	22	
77	24	Good	Good	10 or 11 yrs	do	do	36	
78	40	Fair	Poor	17 yrs	do	do	27	Disease very mild.

In tabulating the cases represented in the above table I have been obliged to accept the statements of the patients; first, as to the fact of revaccination; and secondly, as to the time when it was performed. Their testimony as to whether or not it was successful I have found very unreliable. To use their own language, they often said "It took a little," or "The arm was very sore," and frequently they did not remember whether it "took" at all, but would point to a mark which they said they had always believed was the result of revaccination. Not unfrequently marks were pointed out as the result of revaccination which were an exact counterpart of one or more other marks present on the arm, and which were known to have resulted from the primary vaccination. It is evident, therefore, that it would be very difficult to say how many of the cases recorded in the table should be regarded as authentic examples of smallpox occurring after successful revaccination. Some, I think, should be so regarded.

The more positive evidence of the efficacy of revaccination is to be found in the fact that persons recently revaccinated with effect do not take smallpox when freely exposed to the infection. During my service of twenty-three years no resident physician of the hospital, no nurse, laundress, cook, nor any other employé who was properly revaccinated before entering on duty has taken smallpox. Perhaps I should except a female nurse, who was revaccinated on the first day of her residence in the hospital, with almost typical result. In the course of about two weeks I noticed on the forehead of this nurse, near the edge of her hair, one or two variolous vesicles, which were preceded by but little if any febrile disturbance. At any rate, she was at no time disabled from performing her usual duties.

What vaccination has done for these employés, whose duties have necessarily brought them in the closest possible contact with the infection of smallpox, it will do for any or all who fully avail themselves of its protective influence. I am firmly of the opinion that if all persons were properly vaccinated in infancy, and again at the age of puberty, Jenner's prediction as to the power of this agent to extirpate smallpox from the globe would soon be realized.

In the following and last table which I shall present is contained the principal data at hand in regard to the cases or alleged cases of second attacks of smallpox. There is found in it, also, the same element of uncertainty as to the authenticity of many of the cases as existed in the preceding table, though perhaps to a less degree, and this uncertainty is owing to the same cause, namely, the unreliability of evidence furnished by the patients.

TABLE X.—*Showing the alleged cases of second attacks of smallpox.*

No.	Present age of patient.	Age at which the alleged previous attack occurred.	Whether or not vaccinated prior to the alleged previous attack.	Character of the vaccine mark.	Extent of pitting.	Type of present attack.	Result.	Remarks.
	Years.							
1	35	6 years	Not vaccinated		Very little	Greatly modified	Recovery	Was confined to bed only during the initial stage.
2	31	Childhood	Vaccinated	Poor	do	Very mild	do	Do.
3	22	do	do	Poor	do	do	do	So mild as to be a doubtful case of varioloid.
4	49	do	Not vaccinated.		No pitting	Unmodified	do	
5	49	10 years	Vaccinated	Poor	Doubtful	Modified	do	
6	24	Childhood	Not vaccinated.		No pitting	Unmodified	do	
7	45	19 years	Vaccinated	Not noted	2 or 3 doubtful scars.	Very mild	do	Eruption consisted of only a few papules, which never became vesicular.
8	28	2 years	Not vaccinated.		Well marked	Greatly modified	do	Vesicles few in number and dried up quickly. Was ill only during the initial fever.
9	34	15 years	Vaccinated	Poor	No pitting	Unmodified	Death	
10	31	Childhood	Not vaccinated.		Some pitting	Very mild	Recovery	Presents only 3 or 4 variolous vesicles.
11	20	do	Vaccinated	Good	No pitting	Modified	do	
12	20	10 years	Not vaccinated.		Doubtful	Unmodified	Death	
13	27	8 years	Vaccinated	Poor	No pitting	do	do	Three months pregnant; aborted on the first day of the eruption.
14	22	18 years	do	Good	do	do	do	Confluent.
15	22	do	do	2 good	Very little	Modified	Recovery	Shows about half dozen small scars, said to be the result of a previous attack. Disease at present mild; only 7 days in hospital.
16	13	3 years	Vaccinated	2 good	Slight pitting.	Modified	do	Eruption not even vesicular.
17	17	Childhood	do	No visible mark.	Some pitting	Greatly modified	do	
18	18	14 years	do	Poor	Very little	do	do	Eruption so mild as scarcely to be characteristic; 4 days in hospital.
19	18	6 years	Not vaccinated.		Some pitting.	do	do	Eruption very light.
20	28	10 years	Vaccinated	Poor	Deeply pitted.	do	do	Do.
21	15	Childhood	do	Good	No pitting	Unmodified	do	Thinks he had smallpox when a child.
22	30	25 years	do	Good	do	Modified	do	Says his doctor called the alleged previous attack smallpox.
23	23	6 months	do	Good	Doubtful	do	do	Says she was vaccinated when 4 weeks old.

TABLE X.—*Showing the alleged cases of second attacks of smallpox*—Continued.

No.	Present age of patient.	Age at which the alleged previous attack occurred.	Whether or not vaccinated prior to the alleged previous attack.	Character of the vaccine mark.	Extent of pitting	Type of present attack.	Result.	Remarks.
	Years.							
24	14	3 years	Not vaccinated.		No pitting	Unmodified	Recovery	Says her mother told her she had smallpox at 3 years of age.
25	35	Childhood	Vaccinated	3 good	Very little	Modified	do	
26	31	6 years	do	2 poor	Doubtful	do	do	
27	24	18 months	Not vaccinated.		Deeply pitted.	Greatly modified	do	Eruption only papular.
28	25	10 years	Vaccinated	Good	Some pitting	Modified	do	Three months pregnant: aborted the first day of the eruption; eruption very mild.
29	19	7 years	do	Poor	2 small pits	Unmodified	Death	
30	12	3 years	do	No visible mark.	1 or 2 pits	Modified	Recovery	
31	21	Childhood	Not vaccinated.		No pitting	Unmodified	do	
32	24	16 years	do		do	do	Death	
33	16	7 years	do		do	do	Recovery	
34	21	13 years	Vaccinated	Good	1 pit	Modified	do	
35	22	8 years	do	2 good	No pitting	do	do	2 months pregnant.
36	38	Childhood	do	Fair	do	do	do	
37	44	do	do	Poor	do	do	do	Only a few variolous vesicles.
38	41	31 years	do	Poor	do	do	do	
39	31	11 years	do	Very poor	Doubtful	Greatly modified	do	Eruption barely vesicular.
40	17	2 months	Not vaccinated.		do	Unmodified	do	
41	21	6 months	Vaccinated	Poor	No pitting	do	do	
42	23	6 years	do	Poor	do	Modified	do	
43	24	7 years	Not vaccinated.		Some pitting	Unmodified	Death	About 18 pits on face. It is possible for these to have resulted from chickenpox.
44	41	18 years	do		Well marked	Greatly modified	Recovery	Eruption only papular.
45	50	2 weeks	Vaccinated	No visible mark.	No pitting	Modified	do	Says the alleged previous attack of smallpox occurred about the time she was vaccinated and that two of her sisters had smallpox at the same time and are pitted.

It is certain that very many of the cases recorded in the foregoing table should not be regarded as true cases of recurrent smallpox. For instance, where it is seen that a smallpox patient has never been vaccinated, shows little or no pitting, and is suffering from an unmodified form of the disease, it is more than probable that there has been no previous attack. Slight pitting, when present, is not necessarily proof of such an attack having existed; for the pitting may have resulted from chicken pox, which disease, I well know, is often mistaken for smallpox. So also all those cases having a history of thorough vaccination in infancy, if characteristic pitting of the alleged previous attack is absent, should be regarded as very doubtful cases of recurrent smallpox. It would be very exceptional, indeed, for a person first to take vaccina, then smallpox, and subsequently a second attack of the disease. There is no doubt that a few of the cases recorded in the table should be regarded as genuine second attacks of smallpox, but in most such cases the disease was exceedingly mild—so mild, indeed, in some instances as scarcely to be recognizable. I have never yet seen an unmodified, or even a severe, case of smallpox occur in a person who was deeply and characteristically pitted from a previous attack. Such cases I know may be found on record, but it has not been my fortune to meet with them. I might say, furthermore, that during my many years of service no person has been admitted to the hospital twice suffering from any form of the variolous disease. In view of all these facts I can not but believe that second attacks of smallpox are much rarer than is generally supposed.

DISCUSSION.

Dr. Valentine. The paper we have just listened to with so much pleasure, indorsed and corroborated by the statistics Dr. Welch offers, is most opportune. Particularly now is this the case, when so much agitation is waged against vaccination. Such comments and demonstrations are needed especially to combat the silly anti-Jennerism now so prevalent in Germany, where, not three months ago, a petition was sent to the Government praying for the abolition of the "Moloch of vaccination." The records of this congress, which will go into print, should certainly give this paper due space, and I hope it will reach the general public, lest it be misled by the clamor which may soon cross the ocean. Let the author's valuable paper receive the critical indorsement of this section and of the congress in general, so that by its influence Jenner's prediction may be fully verified. The mission of the congress for the good of the public will then be thoroughly done, even if it accomplishes nothing else.

Dr. Louis A. Duhring, of Philadelphia. I congratulate the author and the congress upon the excellent paper, which introduced so many striking tables, carrying conviction with them, concerning the great protective value of vaccination. It is a boon to humanity which the world does not yet sufficiently appreciate, as shown by the unwarranted opposition still put forth by the laity in Great Britain and Germany at the present day. Such statistics, properly presented, must go far to convince the people of all countries of the great protection which vaccination confers, and it is to be hoped such information may reach the laity everywhere, as well as the profession. I would ask the reader of the paper if he had made any special observations relating to the amount of eruption as bearing on the disease as a whole, and especially as to the mortality.

Dr. Ravogli. Dr. Welch deserves to be highly complimented for his interesting paper. Before the power of the ciphers nobody can make many remarks; the ciphers speak for themselves. I fortunately never had occasion to see many cases of smallpox, as in the city of Cincinnati, since 1881, we were so lucky as not to have had a single case of the disease. However, in my early experience I had occa-

sion to see many cases of smallpox in the hospital of Santo Spirito, in Rome, Italy, where four large halls were kept purposely for this disease. At the time of the government of the priests no compulsory vaccination had been established, and so the low, ignorant class was not vaccinated, and those halls were almost constantly filled with patients affected with variola. After the establishment of the Italian Government compulsory vaccination was ordered, and, gradually increasing the vaccination among the people, the number of the cases of smallpox diminished to such an extent that the smallpox halls were often kept closed. In the epidemic which affected Cincinnati in 1881 I saw several patients not only vaccinated, but also revaccinated a short time before being attacked, with smallpox which was of a malignant nature. After the third or fourth day petechiæ appeared on the body, with symptoms of collapse, and the patient died. Anyhow, I agree thoroughly with the essayist in the value of the vaccination as protection against smallpox. I am an advocate of revaccination, which I believe is a necessity. If I may make a remark on the paper of the essayist, I find that revaccination is not taken into consideration. I find that every pupil going to the high schools, the soldiers taking service in the Army, the prisoners, all who come under the rule of the Government, ought to be carefully revaccinated and the result watched, so as to obtain good marks from the efflorescence.

Dr. Rake. I hope Dr. Welch's paper will become known all over the world. It comes at a most appropriate time. There is a strong antivaccination party in Great Britain, and much pressure is being brought to bear on the Government to relax the penalties for breach of vaccination laws. In Trinidad, where vaccination is being rigorously carried out, there has been no case of smallpox since 1871, when there was a severe epidemic, and the mortality was so high that compulsory vaccination was made legal. Though smallpox frequently occurs in the other West Indian Islands, Trinidad has been quite free since 1871.

Dr. Cobb complimented the writer on his learned and conclusive address.

Dr. W. S. Gottheil. I should like to ask Dr. Welch if he can, from his very large and exceptional experience, answer two practical and important questions: (1) Is the presence of a large, well-marked scar a guaranty against infection? (2) Does a failure of revaccination demonstrate unsusceptibility to the variola poison?

Dr. Welch. Very much indeed do I appreciate the complimentary remarks on my paper. In regard to the question of the quantity of the eruption increasing the danger in smallpox; there is no doubt that where the eruption is most intensely confluent the danger to life is greatest. Discrete smallpox is not very dangerous. Recovery from the hæmorrhagic or malignant type of the disease is very rare indeed. In reply to the question as to whether a typical vaccine scar indicates that the individual is protected against both smallpox and revaccination, I would say that I have frequently seen persons bearing such marks suffer from smallpox, and even perish from the disease. Of course, if susceptible to smallpox, they would have taken the vaccine disease if revaccination had been performed. Failure to succeed with revaccination does not necessarily show that the individual is immune; it may be due to inert virus. I think that susceptibility to smallpox, destroyed by infantile vaccination, returns later in life in the great majority of persons.

PRIMARY DYSTROPHIES OF THE SKIN; WITH AN INTRODUCTION ON THE NOSOLOGY OF DISEASES OF THE SKIN, AND AN APPENDIX ON SECONDARY DYSTROPHIES.

By EDWARD PREBLE, M. D., of Cleveland, Ohio.

All colleagues are agreed that our present modes of grouping skin affections are far from satisfactory; and certain writers, in despair of attaining a good working classification, have taken refuge in a mere alphabetical arrangement of the subject-matter. The vast number and variety of nosological systems have glutted our science with names and synonyms, and have produced a reaction in the shape of nosological nihilism. Now, for this state of affairs there is no valid excuse. The truth lies herein, that in the present state of our science the dermatoses are divisible into two families, namely, those which admit of grouping upon a natural basis, and those which are properly unclassifiable. Numerous writers (I regret that I am unable to give each his due) have during the past few years supported these views in a fragmentary or incidental manner. The present writer has on several occasions attempted to present this doctrine systematically, and especially in a paper read before the 1892 session of the American Medical Association. In this paper attention was called to the fact that our notion of a disease is derived from the sum of its attributes; that is to say, its etiology, locality, pathology, evolution and course, termination, symptomatology, reaction to treatment, etc., and that diseases which have a majority of attributes in common constitute a natural family of dermatoses. It follows, therefore, that when these attributes are known as facts of science, the diseases in question are amenable to a classification which ought to be acceptable to all writers; and that when a majority of attributes are yet in doubt any attempt at classification will be futile, and therefore with diseases of this sort we are quite justified in falling back upon a mere dictionary arrangement of the subject-matter.

There seems to be among many recent writers a consensus of opinion that certain dermatoses are sufficiently understood to admit of a classification which ought to be as nearly perfect and permanent as any in use in any branch of contemporary science. These dermatoses include the following natural groups: Primary dystrophies, acute dermatitides, cutaneous suppurations, poison wounds, occupation dermatoses, parasitic diseases, and finally the infective granulomata, which are due to long-lived microörganisms. At the same time the best authorities are constrained to admit that we are as yet ignorant of the chief attributes and nature of such dermatoses as eczema, psoriasis, lichen planus, prurigo, pityriasis rubra, dysidrosis, lupus erythematosus, etc. The causes are utterly unknown, and while we may have some conception of anatomical seat and pathology, other attributes appear under such protean phases that the inductive method can not be satisfactorily applied.

We have selected the first natural group above mentioned, viz., primary dystrophies, as an example of dermatoses which are perfectly classifiable, and give further on an analysis of attributes. But before we undertake this task we wish to say a word further regarding unclassifiable diseases of the skin. Conditions such as eczema, psoriasis, and lichen planus are eminently protean in form and therein resemble the cutaneous lesions of syphilis, lepra, and tubercle, differing, however, markedly in this, that the former diseases are peculiar to the skin (with the exception of a few mucosæ). These dermatoses are of course due either to local or systemic causes, or to both. If due to the former, there must surely be some element of dystrophy in the skin, which serves as a predisposition and upon which slight and varied irritants are capable of producing a chronic diseased state. That such a thing is possible in dermatology is best shown in the case of late syphilides,

where in a skin which has suffered in early syphilis as, for example, the palm, moderate mechanical irritation, such as come from the tailors' shears or other tool, may cause specific lesions corresponding exactly to the area of local irritation. Other diseases, such as acne and lupus erythematosus, may illustrate the coöperation of irritants and a dystrophic skin in their production. The science of the future will determine the nature of the soil in which these dermatoses are able to flourish, and conversely the reaction of the markedly dystrophic skin to ordinary irritants. If, however, these unclassified dermatoses are due to systemic causes, then we should be able to detect collateral lesions in other organs of the body. It is everyday experience that an eczema, for example, will appear, exacerbate, spread, relapse, recrudesce, etc., exactly as does a rhinitis, a bronchitis, or an enteritis, and under precisely the same circumstances, as exposure, indigestion, etc.; so that in certain cases we may speak, figuratively of course, of a general catarrhal disposition which elects now one organ, now another, for its expression. Or again, an eczema will certainly appear in the same people and under the same circumstances as does a gouty or rheumatic attack in parts of the locomotor system. I have often thought in a given case: Here is a man of a certain age and temperament, a high liver, taking little exercise, and having a family history of gout, with his first attack of eczema; logically, he should have had instead a paroxysm of gout, and his eczema gets well under the antilithic regimen. The clinical evidence is complete that he has had his gout in the skin. The science of the future will isolate the irritant in these cases and the path of its action on the skin. We have said enough to show that before we can classify such dermatoses as eczema further research into both the predisponent soil, and the nature and path of various irritants, from within and without, will be imperative. We now pass on to a study of primary dystrophies.

ABSTRACT OF A PAPER ON PRIMARY DYSTROPHIES OF THE SKIN.[1]

Nosology.—Primary dystrophies form a true family of dermatoses, distinguished by simple redundancy or defect of the anatomical elements of the skin, or by habitual functional perversity, with a purely physiological type of (respectively) development or involvement; and (negatively) by the absence of all of the exciting causes and pathological phenomena of other dermatoses. Redundancies are divisible into simple, diffuse hypertrophies, nævi, and benign tumors. The hypertrophies are limited to a single superficial tissue, with regional predilection, diffuse area, and exquisitely hereditary transmissibility *per se*: and comprise various diffuse forms of hyperkeratosis, hypertrichosis, hyperchromia, telangiectasis, and follicular redundancy. Nævi are sharply circumscribed, often composite, redundancies of the superficial tissues, having no regional predilection, and varying greatly in size, shape, number, location, and composition. They comprise the various so-called moles, and certain sebaceous and corneous formations. Benign tumors are multiple, disseminate redundancies originating in the deeper cutaneous layers, and comprise the dermoids, atheromata, and tumors of the connective tissue series. Occasionally large, isolated forms occur. Defects consist of absent, tardy, or partial development, premature involution of the senile type, and pathological involution of certain anatomical elements of the skin. They include certain forms of atrophoderma, achroma, atrichia, keratolysis, etc., and are often strikingly hereditary. Functional instead of structural perversity is seen in certain forms of hyperelasticity, in exaggerated skin-reflex, in the so-called flush patch and chilblain circulation, and in the production of horny sebum and oily sweat.

[1] The notes of which this is an abstract are not in shape for publication, besides being too voluminous for a short paper.

Etiology.—Heredity *per se* is present so often and so exquisitely that with negative history we may often assume either imperfect data or atavism; and when heredity *per se* is absent, there is often evidence of a general inherited disposition to dystrophy of the skin. Heredity must mean ultimately either atavistic reversion, or the transmitted results of miscegenation and inbreeding. Dystrophies in the site of the original lines of fusion presuppose either fœtal arrest of development or the inclusion of latent embryonal remnants.

Pathology.—Redundancy and defect are but phases of a common dystrophy, and often coëxist. Any distinction between diffuse hypertrophy and homologous tumor-formation is artificial. The life history of primary dystrophies has its parallel in the development or involution, respectively, of the temporary physiological organs (hair, teeth, thymus, mammæ, etc.).

Course.—Redundancies progress slowly to a maximum, and then tend to remain stationary, with occasional spontaneous involution. Defects are likewise progressive, with occasional arrest and, rarely, regeneration.

Diagnosis.—Primary dystrophies require differentiation from forms secondary to local mischief, or to central influence.

Complications.—Primary dystrophies tend to coëxist in the same skin, often in great variety; and high degrees are often associated with dystrophy elsewhere in the body.

Sequelæ.—Dystrophies are elements of the greatest significance as predisponents to the establishment and chronicity of skin diseases.

Treatment.—The indications are to produce arrest, and, respectively, involution or regeneration. This is possible only in a slight degree, although many redundancies may be removed outright by surgical procedure.

APPENDIX ON SECONDARY DYSTROPHIES.

Probably no one, after due deliberation, will question the propriety of making the dystrophies a separate family of dermatoses. As our abstract has discussed only the primary forms, a few words may be added in regard to secondary dystrophies. A number of redundancies and defects may result from local disease or injury, and these are therefore termed secondary dystrophies of local origin. Some of these are analogous to the primary forms, such as hyperchromia, while other forms, such as diffuse hypertrophy of the derma, are probably never primary, but always due to an increased nutrition of the parts, depending on local or central causes. So the interstitial atrophy of the derma which follows certain diseases has no parallel in the primary forms of defect. A still wider departure is present in cicatrices, although they have a primary analogue in spontaneous keloid. Turning now to secondary dystrophies of internal origin, we find a still greater number and variety in the species. Certain redundancies and defects appear to be due to vascular lesion, particularly in the lymphatic system, as seen in elephantiasis of all kinds. Another large group is of distinctly nervous origin, due to lesion of the various members of the nervous system, central or peripheral. The term dystrophy of the skin was in fact originally restricted to the so-called trophic affections of the nerves which supply the skin. Secondary dystrophies of nervous origin appear to be defects and never redundancies. Here belong the cutaneous lesions of wounded nerves, of lepra nervorum, ataxia, syringo myelia, etc. A third and extremely interesting group, and one newly studied, is the secondary dystrophy due to anomalies of the ductless and reproductive glands. The lesions of the skin are often associated with collateral change elsewhere in the body. The glands referred to are the thyroid, thymus, hypophysis cerebri, and possibly the adrenals, and the ovary and testis. It may be shown eventually that lesions of the spleen, bone marrow, etc., are capable of modifying the nutrition of the skin. Our knowledge of the dystrophies of glandular origin is yet in its

infancy, and we therefore forbear to enumerate special affections beyond a mere allusion to myxedema, acromegaly, and certain dystrophies of the pigmentary and pileous systems.

There still remain certain purely artificial conditions which resemble, in some respects, the natural dystrophies, and should therefore be considered here. We refer to the various forms of foreign coloring matter introduced into the skin, intentionally or accidentally, from without or within. Here belong all kinds of tattooing, powder and coal marks, and all dyes and stains, together with argyria and analogous discoloration from within.

Briefly recapitulated, dystrophies are primary or secondary to local mischief, and to vascular, nervous, or glandular influences. Primary dystrophies are either transmitted by descent or due to errors of development. With dystrophies are placed for convenience certain artificial conditions of the skin of a chromatogenous character.

LAS ENFERMEDADES CARBUNCULOSAS Y SU ESPECÍFICO: EL AMONIACO.[1]

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I.

Las enfermedades carbunculosas forman un grupo de afecciones microbianas originarias del ganado vacuno y lanar y trasmisibles al hombre por contagio, realizándose este último por un microorganismo especial: la *bacteridia carbunculosa* (Davaine) ó el *bacillus anthracis* (Cohn), están caracterizadas por una tendencia marcada á la mortificación de los tejidos ó gangrena, que les ha valido en todo tiempo el nombre de carbón ó carbúnculo, acompañada de un estado general más ó menos grave.

El bacilo específico es un ser aerobio que genera la enfermedad con su sintomatología característica por doble acción: mecánica y química. Mecánica, multiplicándose de un modo prodigioso á tal punto que una bacteridia genera en setenta y cuatro horas 137.219'353.312, lo que origina obstrucción de los pequeños vasos sanguíneos y la asfixia consiguiente de los tejidos, químicamente privando á los glóbulos sanguíneos del oxígeno que necesitan para su subsistencia y secretando, una vez vencidos los hematias, una tomaína que produce los síntomas propios de la infección.

Las diversas experiencias de laboratorio practicadas para conocer la acción de los diversos agentes químicos sobre el bacilo del carbúnculo y sus esporos, pueden reasumirse con el Profesor Perroncito, de Turín, en las siguientes conclusiones: Mantienen su actividad completa los esporos durante una hora, á 90 y 95 , y por diez minutos, de 99.5 á 100.4. Además el virus resiste mes y medio á la acción de la glicerina, media hora al alcohol absoluto, veinte minutos al cloruro de zinc, veintiuna horas á la solución saturada de ácido salicílico: $\frac{1}{300}$ de ácido, de diecisiete horas á siete días, cuatro horas; al amoniaco débil, veintiuna horas, y al fuerte, media hora; doce á cincuenticinco minutos á la solución acuosa de ácido fénico al 5 por ciento. Los esporos murieron: en ácido nítrico al 20 por ciento, á las veintiuna horas; de 105 á 134 , á los cincuentiocho minutos; y, de 130 á

[1] El presente trabajo fué leido por su autor en una conferencia habida en la sociedad médica "Unión Fernandina," el 28 de octubre de 1885. Para enviarlo al Congreso Médico Pan-Americano se han suprimido los párrafos de poca importancia, agregándole los datos nuevos adquiridos hasta la fecha.

143°, en once minutos; de 90° á 91° en un tubo de vidrio cerrado á la lámpara, una hora y nueve minutos. Los bacterios fueron inactivos y murieron: de 48° á 50° por 25′ á 30′; en soluciones fenicadas, al 1, 2, 3, 4 y 5 por ciento. Los esporos resistieron: al alcohol absoluto ciento veinticuatro días; ácido fénico, 1 por ciento, sesentiun días; al 5 por ciento, veintiseis días; sublimado al $\frac{1}{3000}$, tres días, dieciocho horas; $\frac{1}{10000}$ por ciento, cuarentidos días; el agua hirviendo con $\frac{1}{3}$ de virus por $\frac{2}{3}$ de agua los alteró. El bacilo murió: en sublimado al $\frac{1}{200}$ á los veinte minutos; al $\frac{1}{100}$ á los treinticinco minutos; al $\frac{1}{1000}$ á las dos horas; al $\frac{1}{6000}$ á los ochentisiete días. Á las temperaturas de 80° á 107°, durante ocho minutos, y después de 107° á 115°, por seis minutos. Después de 12′ entre 80° á 90°, y 21′ entre 80° y 90°, 5′ entre 91° y 93°, y 6′ entre 92° y 94°. Los bacterios murieron: en $\frac{1}{300}$ de ácido túnico, á los cinco minutos; y á los diez en alcohol absoluto.

Citaremos también, tratando de las sustancias que aniquilan la vitalidad del bacillus anthracis, los trabajos de Davaine, en lo que se refieren á la acción del iodo y del sublimado, de los que resulta que, para neutralizar la acción del bacilo se requiere una solución de $\frac{1}{17000}$ de iodo y $\frac{1}{15000}$ de sublimado, como límite extremo.

Pero, haré presente que estas observaciones de laboratorio no están muy acordes con las enseñanzas de la clínica, y que las dosis necesarias de los diversos antisépticos mencionados, quizás si serían dañinas para el organismo del hombre; esto, sin tener en cuenta las transformaciones que se realizan en el seno de la economía. Como prueba de este aserto, dice Colin lo siguiente: "El iodo hace maravillas en los vidrios de reactivos, en presencia de una milésima ó millonésima de gota; pero, según parece, en el organismo no obra de igual manera."

No me ocupo del estudio de las múltiples causas que favorecen el desarrollo y contagio de las enfermedades carbunculosas, por ser muy conocido y poco necesario para el objeto que me propongo. Igual consideración hago en lo que se refiere á la sintomatología, marcha y pronóstico de estas afecciones.

II.

Las formas bajo las que se presentan las enfermedades carbunculosas en el hombre son: la pústula maligna, el edema maligno, y la fiebre carbunculosa. Las tres reconocen la misma causa, la penetración del bacillus anthracis en la economía; su diversidad es debida á los distintos efectos que ocasiona la bacteridia según la vía por la que se introduce en el organismo.

Pero antes de pasar adelante debo dejar definitivamente sentado que la bacteridia es un ser aerobio que necesita oxígeno para su subsistencia, y que su mejor medio de cultivo en el organismo es la sangre; de modo que cualquiera que sea la vía por la que penetra procura llegar hasta el torrente circulatorio, en donde encuentra al glóbulo sanguíneo, también ávido de oxígeno, y se establece entre ellos una lucha por la existencia; cuando el organismo posee suficientes elementos de vitalidad vence el hematia, se aniquila la bacteridia sin reproducirse y se restablece el estado normal—es la fuerza medicatriz de los autores antiguos, que explica la curación espontánea de algunos casos de enfermedades carbunculosas—pero, por el contrario, cuando el organismo se encuentra debilitado por una causa cualquiera, ó que el ataque ha sido muy violento, entonces el bacillus anthracis predomina, repulula y se realiza la infección de la economía.

La localización del bacillus anthracis en la superficie cutánea da margen á la pústula maligna.

La bacteridia se insinúa por los intersticios de los tejidos de la piel, previa su solución de continuidad, priva á estos del oxígeno que contienen, los gangrena, siendo esta la causa del núcleo negro é indurado que forma el centro de la pústula; después gana los linfáticos para llegar por ellos á los ganglios, produciendo el edema inflamatorio que rodea á la pústula y el infarto de los ganglios tributarios

de los linfáticos del sitio donde radica la afección; del sistema linfático pasa al torrente circulatorio, donde puede aniquilarse ó reproducirse, según hemos visto antes, produciéndose la infección en el segundo caso, la que siempre es tardía por el largo trayecto que tiene que recorrer la bacteridia para llegar á su mejor medio de cultivo: la sangre.

Cuando la penetración de la bacteridia se realiza por una mucosa próxima á las aberturas naturales, ó por una solución de continuidad profunda de la piel, se origina el edema maligno. En este caso el germen se encuentra en un medio en que la circulación es más activa, su acceso al torrente circulatorio es más fácil, y sin ocasionar la mortificación primitiva de los tejidos, los ataca de una manera violenta, engendra un edema inflamatorio intenso é infecciona al organismo con mayor rapidez que en el caso anterior.

Finalmente el organismo puede ser atacado por la mucosa de los órganos respiratorios ó digestivos, modo de penetración que puede asimilarse á la inoculación directa por el torrente circulatorio, pues es sabido la rapidez con que las diversas sustancias introducidas por estas vías pasan directamente á la sangre. En este caso se presenta la fiebre carbunculosa; se realiza directamente la infección de la economía sin lesión local, el bacillus anthracis ha encontrado pocos obstáculos para difundirse rápidamente por la economía y el ataque al organismo es así más enérgico y seguro.

Se comprende fácilmente, según esto, la gravedad relativa de estas tres formas. La pústula maligna ocupa el último lugar en la escala: su curación expontánea, lo mismo que la de las otras formas, no es rara, y la lentitud de su marcha permite destruir al causante del mal, antes que se apodere por completo del organismo. Sigue después el edema maligno, en el que la marcha ya algo rápida del bacillus anthracis, obliga á combatirlo con más energía. Por último, en la fiebre carbunculosa, el ataque al organismo es rápido, violento; la bacteridia penetra directamente á la sangre; de consiguiente es necesario batirla en el mismo medio en que mejor se desarrolla: en el líquido nutritivo por excelencia. Felizmente esta última forma, algo frecuente en los animales, es algo rara en el hombre, á tal punto que algunos autores dudan de su existencia; pero existen hechos positivos que demuestran la realidad de ella.

III.

Prescindiendo de las diversas medicaciones más ó menos inútiles que se han empleado contra la pústula y el edema malignos, que son, como ya lo he dicho, las dos formas más comunes de las enfermedades carbunculosas en el hombre, el tratamiento clásico de estas afecciones ha sido, y es, la insición y la cauterisación del sitio primitivo del mal. En los casos en que la pústula es muy extensa, se excisan los colgajos que resultan de la insición, y en la solución de continuidad que resulta se aplica directamente el cáustico. El cauterio actual es el que ha gozado de más boga, y de los cáusticos potenciales se han empleado casi todos, hasta el nitrato de plata (Gautheret, Tesis de Paris, 1859), cuyo débil poder es de todos conocido; pero el que ha merecido la preferencia, y es indicado por todos los autores en primera línea, es el bicloruro de mercurio, sal bastante corrosiva y que hoy ocupa uno de los primeros lugares en la medicación antiséptica. La mayoría de nuestros prácticos ha usado siempre el protocloruro de antimonio (manteca de antimonio) cuerpo que á su excesivo poder reune la singular ventaja de ejercer una acción especial sobre los venenos de orígen séptico, los virus de orígen animal como se les llamaba antes; y es quizá por esto que las pústulas malignas rara vez llegan entre nosotros á su período de infección.

Esta medicación instituida en los tiempos en que la palabra virus carecía de significación precisa, es sin embargo racional, y se encuentra en conformidad con los descubrimientos modernos. Antes del establecimiento definitivo de la teoría

parasitaria, se conocían perfectamente los efectos de los virus, pero no podía encontrarse la explicación racional de ellos; á los virus se les concedía una acción oculta, invisible, impalpable, en una palabra, incomprensible; necesitaban, sí para ejercer su acción, una vía favorable para introducirse á la economía.

La observación atenta había demostrado que el virus carbunculoso ejerce primero su acción local antes de penetrar al interior del organismo, de consiguiente lo lógico, lo racional es tratar de impedir esa penetración; y el medio más eficaz para ello destruirlo antes que ésta se realizara. Á ese fin obedece el empleo de los cáusticos, que no puede menos que aprobarse, hoy que se sabe que la bacteridia carbunculosa permanece por algún tiempo en las mallas de la piel antes de introducirse al torrente circulatorio é inficionar al organismo. Acepto, pues, la cauterización primitiva del tumor, pero con ciertas reservas respecto á su manual operatorio y á la sustancia que debe emplearse, reservas que expondré al final de este incorrecto trabajo.

Fuera de la cauterización, no se ha empleado antes ningún agente capaz de atacar directamente al gérmen de la enfermedad en la profundidad de los tejidos; pues los demás medicamentos usados, lo son únicamente para llenar las indicaciones que sucesivamente se presentan, evacuantes al principio de la afección, atemperantes para moderar la elevación térmica, tónicos para levantar ó sostener las fuerzas del organismo, tónicos diversos, para favorecer la cicatrización de las heridas resultadas de la aplicación del cáustico, etc.

Cuando Davaine adquirió el pleno convencimiento de que la bacteridia carbunculosa era el agente exclusivo de la producción y trasmisión de las enfermedades carbunculosas, tanto en los animales como en el hombre—convencimiento que fué robustecido por las ulteriores experiencias de Pasteur, Jobert, Koch, Toussaint, Duclaux y otros: y después de haber encontrado el medio de atenuar la virulencia del bacilo, de modo de convertirlo en vacuna preservativa, extendió el campo de sus experiencias á la investigación de los agentes capaces de aniquilar la vitalidad de la bacteridia. En efecto notó que neutralizando la sangre de los animales atacados de carbúnculo, por soluciones de diluídas de iodo, de ácido fénico ó de amoniaco é inoculándola después á otros animales, la enfermedad no se reproducía en estos últimos; quedando así demostrado que dicho líquido se había vuelto inactivo, en una palabra, las bacteridias que contenía habian dejado de existir.

Estas esperiencias hechas á principios del decenio pasado, y oportunamente comunicadas á la Academia de Medicina de Paris, hicieron pensar á algunos prácticos si no sería posible aplicarlos como medio curativo tanto en el hombre como en los animales; pues si las sustancias antes mencionadas, consideradas, y con justicia, como antivirulentas, aniquilaban el germen de la enfermedad en la sangre extraída de los animales enfermos lo mismo que en los diversos medios de cultura, su acción tenía que ser la misma en el organismo del hombre ó de los animales presa de la bacteridia — habiendo sido Declat el primero que empleó el ácido fénico al interior para combatir el carbúnculo en los animales. A éste siguieron muchos que emplearon el ácido fénico y el iodo, convenientemente diluidos, para destruir el microbio, administrándolos en algunos casos por las vías digestivas y en todos en inyecciones hipodérmicas en el sitio del edema inflamatorio. Así nació el método que se llamó de las "inyecciones neutralizantes antivirulentas en el tratamiento de las enfermedades carbunculosas."

Los casos tratados de este modo que he podido encontrar en los documentos que he consultado sobre esta cuestión son los siguientes: Un edema maligno de los párpados, curado por los Dres. Bienfait y Gentilhome (1872) empleando las inyecciones de licor de Labarraque. Uno de pústula maligna, curado por los Dres. Jaillot y Collot (1873) por medio de inyecciones iodo-ioduradas. Un edema maligno de la cara, curado por el Dr. Rainfert (1873) por inyecciones de ácido

fénico. Una pústula maligna, tratada por el Dr. Verdureau (1874) por las inyecciones de ácido fénico. Una pústula maligna, tratada por el Dr. Rainvert (1874) por las inyecciones de iodo-iodurado. Un edema maligno de la pierna, curado por el Dr. F. Meplain (1875) por las inyecciones de ácido fénico. Un caso observado por el Dr. Baladon (1878) con la solución iodo-iodurada. Una pústula maligna, tratada por el Dr. Remy y curada con la solución iodo-iodurada (1878). Un caso del mismo autor y en el mismo año por el ácido fénico. Quatro casos del Dr Chipault (1880) curados por las inyecciones iodo-ioduradas. Dos casos del Dr. Rigault, curadas también por la solución de iodo (1878). Siete casos del Dr. René Raimbert (1880) tratados por el ácido fénico y el iodo, en los que se obtuvieron cuatro curaciones y tres insucesos. Dos casos del Dr. Richet (1880 y 1883) curados por el iodo. Varios casos del Dr. Serains (1887) curados por el iodo. Ciento y dos casos recopilados por el Dr. Jarnovsky, curados de 1876 á 1884, empleando las inyecciones hipodérmicas de ácido fénico al $\frac{2}{100}$. Veinte observaciones recopiladas por el Dr. Mandiola Gana, de Santiago de Chile (1890), curados todos, y en los que se empleó el ácido fénico en siete casos, el iodo en doce y el bicloruro de mercurio en uno.

Tales son los casos felices que conozco—pues prescindiendo de los no publicados, se consignan algunos insucesos—del empleo de las sustancias neutralizantes del bacillus anthracis en el tratamiento de las enfermedades carbunculosas. En todos ellos los medicamentos empleados han sido el iodo, el ácido fénico y el sublimado, con exclusión del amoniaco, cuyo poder antivirulento había sido ya indicado por Davaine: la vía de administración ha sido la hipodérmica en el sitio próximo al lugar afecto, en las partes edematosas; y las inyecciones empleadas han sido algo numerosas, habiendo llegado en el caso del Dr. Meplain á la cifra de 63, no habiendo escaseado en algunos de ellos los accidentes locales.

Este método racional, fecundo en resultados prácticos y llamado á prestar importantes servicios, no ha dejado de tener sus detractores, entre ellos el Dr. Raphael, de Provins, que comentando en la Gazette hebdomadaire de médecine et de chirurgie, Paris, 1875, algunos de los casos que antes cito, los considera á todos únicamente como curaciones espontáneas, declarando que se habrían obtenido aún sin ninguna medicación. En el año de 1880, al dar cuenta Davaine, en la sesión de la Academia de medicina de Paris del día 27 de julio, de sus experiencias y de los hechos prácticos que las habían seguido, Collin las consideró también como casos de curaciones espontaneas, á lo que Davaine contestó textualmente como sigue: "Se puede siempre hacer la misma objeción á todas las medicaciones. Cuando el sulfato de quinina cura la fiebre, se puede también decir que esa fiebre hubiera podido curarse espontáneamente. La misma respuesta podría darse á todos los que niegan la evidencia de algunos hechos, principalmente en el caso del carbúnculo, en el que un médico notable, el Dr. Joux, había dicho en 1858 que la medicina expectante en el carbúnculo equivale casi á un homicidio involuntario." (Cavasse, Annuaire général des sciences médicales: Paris, 1859.)

Antes de concluir esta parte quiero dejar constancia de que en ninguno de los casos curados por las inyecciones neutralizantes de sustancias antivirulentas que se han publicado, se ha llevado el agente antiséptico directamente al torrente circulatorio. El método de inyecciones intravenosas en el tratamiento de las enfermedades carbunculosas es exclusivamente peruano.

Los primeros casos de él, que citaré más adelante, se refieren al año de 1882, y en el año de 1884 nuestro antiguo catedrático de patología médica, el Dr. Tomás Salazar, sin tener conocimiento de los hechos anteriores, y guiado únicamente por el convencimiento que tenía de poder atacar al bacillus anthracis en la sangre, empleó las inyecciones intravenosas de ácido fénico en un caso de pústula maligna que progresaba á pesar de la cauterización, obteniendo una curación completa.

He aquí la correspondiente historia clínica: Juan Porsales, de constitución robusta, de 29 años, se presentó á nuestra observación el 19 del pasado abril; tenía seis pústulas malignas, tres en el antebrazo derecho, una en la mano del mismo lado, otra en la sien izquierda y la sexta en el cuello. Esta última había producido una gran tumefacción de toda la región cervical. El enfermo tenía fiebre alta, dísnea y un mal estar general.

Refería él que hacía tres semanas había comido carne de un novillo que había muerto en la chacra, que el 14 se le hincharon las glándulas del cuello (adenitis), que el 17 le dió una fiebre fuerte y se le hincharon también el pecho y la cara, notando entonces las seis pústulas malignas ya indicadas. El mismo 19 vimos al enfermo en consulta con el Dr. Iturrizaga, y acordamos incidir todas las pústulas y cauterizarlas con ácido nítrico, administrándole una poción tónica y antiespasmódica. El 20 se agravó el enfermo; la fiebre era más alta; la tumefacción tan considerable que producía dísnea y disfagia; la inquietud del paciente era extraordinaria. Visto este estado tan grave y recordando que el exámen microscópico de la sangre en la afección carbunculosa manifiesta la existencia de un microbio (bacteria) en ese líquido, no vacilé en hacerle inyecciones intravenosas de ácido fénico; se disolvió un gramo de ácido fénico en 200 gotas de agua destilada. Se le inyectaron 50 gotas en tres venas. A las pocas horas noté una grande mejoría: se le repitió la inyección dos veces más al día. Al siguiente el alivio era mayor y se le hicieron otras dos inyecciones. Al tercer día el enfermo estaba apirético y la tumefacción había disminuido y en los días siguientes desaparecieron todos los accidentes, quedando sólo un abceso superficial en el cuello. También he sabido que otras cinco personas que comieron la carne del mencionado novillo murieron, una de ellas asistida por el Dr. C.

Esta observación es de grande importancia; prueba que los microbios de la sangre pueden destruirse con el ácido fénico llevado directamente al torrente circulatorio, el que hace que cesen todos los accidentes del virus carbunculoso.

La literatura médica no registra ningún caso de enfermedad carbunculosa tratado por el amoniaco, pues lo único que se encuentra es una vaga indicación de su uso al interior en la pústula maligna en la Tesis de Gautheret, París, 1859, y, sin embargo, las pocas observaciones que más adelante presento, incompletas como son, prueban de una manera irrecusable la potencia anticarbunculosa, si se me permite la frase, del amoniaco, y su superioridad sobre el ácido fénico y el iodo generalmente empleados. Ya antes he indicado que Davaine al hacer sus experiencias para descubrir las sustancias que neutralizan la virulencia de la sangre carbunculosa había estudiado la acción del amoniaco, y la reconoció muy poderosa en este sentido.

Sin embargo, su uso no se generalizó y siempre se ha considerado el amoniaco simplemente como sustancia excitante, pero su poder antiséptico no puede desconocerse; pruébalo su eficacia ya juzgada en las mordeduras de las serpientes y demás animales venenosos, y el ocupar el 26º lugar en la escala de Miguel (Bull. gén. de thér. méd. et chir.), á pesar de lo que no han faltado autores, como los señores Arloing, Cornevin, y Thomas, que ocupándose de la acción de los diversos antisépticos sobre el virus carbunculoso, colocan al amoniaco entre los cuerpos que no destruyen la virulencia del bacilo (Duclaux, Chimie biologique, Encyclopédie chimique de Fremy, Tome IX, Paris, 1883). Por desgracia Duclaux, al citar este trabajo, no indica el modo como se han realizado estas experiencias, que están en desacuerdo con la clínica, y con las propiedades bastante conocidas del amoniaco.

En efecto, el amoniaco, como se sabe, es uno de los cáusticos más poderosos que se conoce; aplicado directamente sobre la piel la irrita, y si su permanencia es prolongada la irritación va hasta la gangrena de los tejidos; sus vapores causan una inflamación violenta é insoportable de las membranas mucosas. Introducido al organismo por la vía estomacal produce una excitación, un aumento de la caloricidad, aceleración de la circulación, activa las secreciones urinarias y de las glándulas de la piel; pero sus efectos son bastante pasajeros porque es una de las sustancias más difusibles entre los diversos agentes terapéuticos; no bien se le ha ingerido cuando penetra al torrente circulatorio, lo recorre en toda su extensión y se elimina rápidamente del organismo. Algunos autores, entre ellos

Halford (Lo Sperimentale, 1875), creen que el amoniaco se transforma en el estómago en cloruro de amonia, sal menos antiséptica que el amoniaco en sustancia; y, teniendo esto en consideración y deseando utilizar la acción casi específica de este cuerpo en las intoxicaciones de orígen animal. Halford fué uno de los primeros que lo inyectó directamente en la sangre. Es más que probable que sea esta una de las razones por la que no se ha generalizado su uso en el carbúnculo, pues es sabido que las inyecciones intravenosas en el hombre han sido siempre empleadas con mucha parsimonia. Introducido al torrente circulatorio por inyección intravenosa sus efectos son más rápidos y más marcados, siendo este uno de los medios más poderosos que posee la ciencia para levantar las fuerzas decaídas del organismo; destruye la plasticidad de la sangre, impidiendo así la obstrucción de las pequeñas radículas arteriales y venosas; y, finalmente, tiene la ventaja, administrado por esta vía, de perder su propiedad cáustica diluyéndose en la gran masa líquida de la sangre.

Su poder anti-virulento es bastante conocido: el amoniaco mata á los organismos inferiores; el aire por el que ha pasado una corriente de sus vapores se encuentra libre de todo gérmen orgánico; y, como ya lo he dicho, su eficacia en el tratamiento de los envenenamientos por las sustancias sépticas de orígen animal (mordeduras de serpientes y demás animales venenosos), es cosa ya juzgada por la ciencia.

Existe una enfermedad mucho más grave que las afecciones carbunculosas, y que es originada, según los estudios de Duclaux, por el vibirion piogénico—me refiero á la septicemia (infección purulenta). Esta afección que por muchos años ha sido el oprobio de la cirugía, y contra la que han sido impotentes todas las medicaciones empleadas, se dominó por primera vez el día que un práctico tan audáz como instruido osó atacar directamente á su agente productor en el torrente circulatorio. Ninguno de vosotros puede desconocer las curaciones obtenidas por nuestro ilustrado profesor de clínica-quirúrgica, el Dr. Lino Alarco, por las inyecciones intravenosas de amoniaco empleadas en el tratamiento de la infección purulenta, muchos años antes que se conociera la naturaleza microbiótica de la afección y que se hubiera implantado la curación antiséptica de las heridas.

El amoniaco que es uno de los agentes antizímicos más poderosos que combate la postración del organismo, que puede inyectarse directamente en las venas hasta la dosis de 30 gotas; que una vez en el torrente circulatorio se difunde rápidamente, destruye á las bacterias que en él se encuentran, siendo completamente inocuo para el glóbulo, desobstruye los pequeños vasos impidiendo el éxtasis circulatorio por disminuir la plasticidad de la sangre; es el medicamento que llena todas las indicaciones en el tratamiento de las enfermedades carbunculosas.

Voy á exponer los hechos prácticos á que he hecho referencia, para después establecer las ventajas que tiene el amoniaco sobre las otras sustancias que se han empleado como neutralizantes.

Observación I.—En los primeros días del mes de mayo de 1882, fué conducida al Hospital de Santa Ana, y colocada en la cama No. 21, de la sala de la Vírgen, servicio del Dr. Néstor Corpancho (en el que yo era interno) la enferma Abigail Balarezo, mestiza, de 18 años de edad, soltera, temperamento sanguíneo, y constitución fuerte.

Según los datos que se obtuvieron sobre sus antecedentes, la afección que la aquejaba se había iniciado seis días antes de su ingreso al hospital, día en que estando sentada en la tapia de una de las chácaras próximas á Lima, sintió una picadura en la parte media ó interna del muslo derecho. A las pocas horas se presentó un punto rojo en el sitio de la picadura, empezó á hincharse el muslo y sobrevino, al mismo tiempo, un lijero movimiento febril. Trasladada á Lima se desarrolló, según la relación del médico que la asistió, una pústula maligna muy extensa en la parte ya dicha del muslo, la que fué incindida y cauterizada con la pasta de Viena por dos veces consecutivas. Las cauterizaciones no tuvieron ningún buen resultado y el mal siguió avanzando de una manera rápida, á tal

punto que al sexto día, día de su ingreso al hospital, se encontraba en pleno período de infección, como lo demuestra el siguiente cuadro sintomático:

Decúbito dorsal, coma profunda con respiración anhelosa, la enferma no se daba cuenta de lo que pasaba á su rededor: cara roja é inyectada, ojos brillantes, lengua seca y fuliginosa, pulso á 120, pequeño, depresible; vientre meteorisado, diarreas. El muslo y todo el miembro inferior del lado derecho atacados de un edema duro é intenso; no puede darse mejor cuenta de su estado que comparándolo á una botija; los surcos invisibles que existen en la piel y que unen la base de los folículos pilosos, aparecían como anchas y profundas grietas; en la parte media é interna de dicho muslo se notaba una gran escara negra, de 20 centímetros de diámetro poco más ó menos, rodeada de un círculo rojo y brillante.

Dados los antecedentes del caso y en presencia de un estado tan alarmante, el diagnóstico no podía ser dudoso; se trataba de "una pústula maligna que había llegado rápidamente al período de infección," y como consecuencia se desprendía un pronóstico gravísimo; esa enferma estaba irremisiblemente condenada á la muerte, con los medios de que disponía entonces la ciencia.

Se le prescribió una poción fuertemente estimulante con extracto blando de quina, cognac y 10 gramos de acetato de amoniaco, y como tópico polvos de alcanfor y cataplasmas emolientes.

Siguió con el mismo régimen por dos días durante los que no se modificó nada su estado general, aumentando el edema á tal punto que hubo que practicar dos insiciones largas y profundas á los lados de la placa gangrenosa, con el objeto de desingurgitar un poco los tejidos.

Al tercer día de su permanencia en el hospital, noveno de su enfermedad, el jefe del departamento, Dr. N. Corpancho, me ordenó le hiciera una inyección intravenosa de 10 gotas de amoniaco líquido en 10 gotas de agua destilada. La forma redondeada del brazo, la lentitud de la circulación causada por la adinamia profunda, hicieron muy laboriosa la inyección, la que pudo practicarse en una de las venas inferiores de la cara dorsal del antebrazo izquierdo. En el momento mismo de la inyección la enferma manifestó su sufrimiento por algunos gritos inarticulados, y se notó una notable reacción. En la tarde del mismo día se practicó una segunda inyección intravenosa con la misma dósis.

Al día siguiente pudo notarse una ligera remisión de los síntomas; el coma no era tan profundo; el pulso se había levantado y era menos frecuente; el edema había disminuido notablemente. Animados por este resultado se insistió en el uso del amoniaco, y continuando con la misma medicación interna se le inyectaron intravenosamente 10 gotas de amoniaco líquido en 10 gotas de agua destilada, con la orden de practicar una segunda en la tarde en caso de persistir el estado de gravedad. Esta segunda no la apliqué, por que al visitarla en la tarde noté, con gran satisfaccción, una notable mejoría.

En efecto, la mejoria de los síntomas graves se acentuó más al día siguiente, á pesar de lo que, y como para confirmar la curación, se le practicó otra inyección intravenosa de amoniaco con la misma dósis.

En los días subsiguientes continuó la mejoría, persistiendo, sí, la diarrea que fué combatida con el óxido de zinc, la trementina, etc.; y, continuando con la medicación adecuada á los síntomas que sucesivamente se fueron presentando, permaneció en el hospital más de 3 meses, tiempo que necesitó para repararse la extensa solución de continuidad del muslo.

Debo hacer notar que como prueba evidente de la infección general, pudo notarse desde los primeros días de su restablecimiento una parálisis de la lengua, análoga á las que sobrevienen en los casos graves de difteria y causada, según todas las probabilidades, por alguna pequeña embolia del bulbo, sitio del orígen real del nervio hipogloso, de la que se restableció lentamente.

Como accidente consecutivo á las inyecciones, aparecieron dos escaras; una en cada antebrazo, en la parte inferior de su cara dorsal, pero ni el más lijero síntoma de flebitis.

Observación II.—En el mismo año y en un día lunes (no recuerdo precisamente la fecha) por la mañana, ingresó al número 12 de la sala de la Virgen, servicio del Dr. N. Corpancho (siendo todavía yo su interno), una mujer india, de unos 32 años, de profession chacarera, de temperamento linfático, constitución regular. El sábado anterior, en la tarde, había estado arreando unos carneros y se acostó sin ninguna novedad. El domingo por la mañana amaneció muy desasosegada, con los párpados del lado derecho sumamente hinchados, fiebre, pulso llano y frecuente, lengua seca y mucha sed.

Vista ese mismo día por un facultativo que tomó su afección por un flemón, le hizo aplicar doce sanguijuelas, y le administró derivativos intestinales y medicamentos temperantes. El resultado de este tratamiento fué completamente negativo, y el edema siguió su marcha progresiva hasta invadir casi toda la mitad derecha de la cara.

En el momento en que la vi en el hospital presentaba el siguiente sindrome clínico: un edema duro y rojo que teniendo por centro á los párpados del lado derecho, se extendía á toda la región frontal, la región malar, invadía el carrillo del mismo lado, la mitad correspondiente de la nariz y del labio superior; pulso lleno y frecuente, piel árida, lengua seca, sed y aneroxia: además se notaba en el ángulo interno del ojo dos pequeñas vesículas llenas de una serosidad sanguinolenta.

¿La etiología del presente caso y su marcha excesivamente rápida, no eran motivos suficientes para pensar en una enfermedad carbunculosa? Antes no había visto ningún caso de edema maligno, y sin embargo no vacilé en establecer ese diagnóstico, pues si alguna duda hubiera existido, había bastado para disiparla el insuceso de la medicación poderosamente antiflogística empleada la víspera.

Establecido el diagnóstico, ¿cuál era la medicación más adecuada? Los cáusticos se presentaban naturalmente los primeros; sin embargo no me atreví á hacer una cauterización extensa, tal como hubiera sido necesario practicarla, en una región tan delicada y que habría dejado como consecuencia desórdenes gravísimos. Me limité, pues, como tratamiento local, á practicar tres insiciones extensas y profundas que limitaron los párpados. La serosidad sero-sanguinolenta que fluyó de las insiciones confirmó mi diagnóstico.

Como tratamiento general pensé en el amoniaco, y tentado estuve de introducirlo por las venas, recordando el caso anterior. Pero se vacila, cuando siendo alumno se carece de la práctica suficiente, y se recuerda constantemente los inmensos peligros que los autores atribuyen á las inyecciones intravenosas. Prescribí, pues, el amoniaco por la vía estomacal á la dosis de 20 gotas en 120 gramos de julepe gomoso, para que tomara por cucharadas cada dos horas; y en el sitio de las insiciones, defensivos de agua alcoholizada con alcohol alcanforado y cataplasmas emolientes.

La remisión de los síntomas en este caso fué más marcada que en el anterior. El mismo día por la tarde pudo notarse una diminución notable del edema; disminución que se acentuó más al día siguiente, en el que se reemplazó la poción con otra que contenía extracto de quina, alcohol y 5 gramos de acetato de amoniaco.

La enferma se hubiera restablecido rápidamente á no haber sobrevenido una erisipela el jueves de la misma semana que fué fácilmente yugulada por el percloruro de hierro, y á los 10 días de su permanencia en el hospital, salió completamente curada.

Observación III.—Siendo interno del departamento del Dr. Morales, en el Hospital de Santa Ana, en el año de 1883, fué llevada al No. 11 de la Sala de San Antonio, una mujer, india, de 38 años poco más ó menos, chacarera, temperamento linfático, constitución fuerte. La enfermedad que la conducía al hospital era una pústula maligna en el carrillo del lado derecho; se encontraba en el octavo día de la afección, y el edema era poco extenso. Por orden del jefe del departamento, practiqué una incisión crucial y la cauterizé con el ácido nítrico; en la tarde de ese mismo día había reaparecido la zona vesicular, prueba evidente de la ineficacia del tratamiento: nueva insición y nueva cauterización con el ácido nítrico. Al siguiente día reaparición de la zona vesiculosa, aumento notable del edema que se extiende hasta el cuello, pulso lleno y frecuente, sed intensa, insomnio; se prolongan nuevamente las insiciones y se la cauteriza con el protocloruro de antimonio. En la tarde se notó una ligera remisión de los síntomas, que desapareció al diá siguiente en que hubo una exacerbación marcada; aumentó el edema hasta impedir la deglución y amenazó oponerse á la respiración; había intranquilidad, fiebre, lengua muy seca, en una palabra, se iniciaban los síntomas de la infección.

Se practicó una nueva cauterización con el nitrato ácido de mercurio y un desbridamento extenso en la región lateral del cuello, á pesar de lo que siguió su marcha progresiva la enfermedad. En este estado la enferma, vista la impotencia de los cáusticos, y recordando siempre el caso de la Abigail Balarezo, propuse al Dr. Morales practicar en dicha enferma las inyecciones intravenosas de amoniaco. El Dr. Morales accedió á mis deseos, y con su autorización hice una inyección intravenosa en la vena cefálica, con 10 gotas de amoniaco líquido en 10 gotas de agua destilada. No hubo necesidad de practicar una segunda inyección, pues en la tarde la mejoría era muy notable y esta se fué acentuando más y más en los días subsiguientes, hasta el día en que la mujer dejó el hospital con su herida todavía en vía de cicatrización, pero con su estado general satisfactorio.

Observación IV.—De la práctica particular del Dr. Morales, 1883: En la calle de Huancavelica: un hombre con 3 pústulas malignas en un brazo, inútilmente cauterizadas, y curadas por el amoniaco líquido empleado en inyección intravenosa.

Observación V.—De la práctica particular del Dr. N. Corpancho, 1883: Una mujer con una pústula maligna en la región maseterina izquierda que resistió á varias cauterizaciones enérgicas y sucesivas, y que se dominó completamente por una inyección intravenosa de amoniaco.

Observación VI.—La Sra. Manuela de R., de 34 años de edad, de estado casada, multípara, mestiza, temperamento linfático, constitución regular y con cinco años de residencia en la Hacienda de Pátapo, en el Valle de Chiclayo, sintió el día 4 de junio del año de 1886, á las 3 horas p. m., la picadura de un insecto en la parte superior y externa del antebrazo derecho, picadura que fué seguida de la formación de una ligera mancha rojiza en el lugar indicado.

La noche del 4 al 5 la pasó sin novedad, pero en las primeras horas de la mañana del 5 sintió un desasosiego acompañado de dolor en la parte afecta, hinchazón y rubicundez del miembro correspondiente, notando, al mismo tiempo, un levantamiento de la mancha que había quedado en el sitio de la picadura. Para calmar el dolor y creyendo (la enferma) que se trataba de un forúnculo (chupo) incipiente, se aplicó algunas cataplasmas de harina de linaza. Pero, en vez de encontrar el alivio que buscaba, el mal siguió progresando, y en la mañana del día 6 (en que por primera vez ví á la enferma), presentaba el siguiente cuadro sintomático: 105 pulsaciones por minuto, sed intensa, poco dolor, edema de la parte superior del antebrazo é inferior del brazo derecho, rubicundez intensa, pápula negruzca en el centro y zona vesicular al rededor.

El diagnóstico no era dudoso: la etiología, la marcha rápida de la enfermedad, los síntomas locales, todo me autorizaba para diagnosticar una pústula maligna. Y, establecido ese diagnóstico, tenía que proceder tal como lo había indicado, pues se me presentaba la primera oportunidad para confirmar de un modo práctico el tratamiento que había señalado como más favorable y más en conformidad con el carácter microbiótico de la afección.

Practiqué una incisión crucial y toqué la superficie cruenta con un pincel empapado en la solución oficinal de amoniaco, ordenando, para el resto del día, cataplasmas emolientes y la siguiente poción:

	Gramos.
Mucílago de goma	100
Acetato de amoniaco	6
Tintura de acónito	2

M. Por cucharadas, una cada 2 horas.

El resultado de este tratamiento fué espléndido. Al día siguiente encontré á la enferma apirética, tranquila, el edema casi había desaparecido, y la curación siguió su marcha progresiva sin accidente alguno, á tal punto que veinte días después apenas quedaba una pequeña solución de continuidad en muy buena vía de cicatrización.

Como se ve, pues, en los seis casos de afecciones carbunculosas en que se ha empleado el amoniaco, se ha obtenido la curación rápida y casi inmediata.

Estos hechos se encuentran en desacuerdo, como ya lo hemos visto antes, con las experiencias de laboratorio, de las que han deducido Arloing, Cornevin y Thomas, que el amoniaco tanto en vapores como líquido no destruye la virulencia de la bacteridia carbunculosa, pero los mismos autores han reconocido que este micro-organismo puede hacerse inofensivo sin perder su vitalidad, dato que es importante para la clínica, pues siendo el organismo inhospitalario para el microbio, le bastará una sustancia que destruyendo la virulencia del intruso, le permita utilizar todas sus fuerzas en expulsarlo al exterior.

Por otra parte, no se debe olvidar que al aplicar las experiencias de laboratorio al hombre hay que tener en consideración al organismo de este, que es el factor más importante en la producción de las enfermedades, explicándose por esto los desacuerdos bastante notables que han existido y existirán tanto en terapéutica como en microbiología, entre los químicos y los clínicos.

Veamos lo que pasa con el amoniaco y el bacillus anthracis.

La bacteridia carbunculosa una vez en la sangre se reproduce de una manera prodigiosa, su pululación activísima ocasiona la obstrucción de las pequeñas radículas arteriales, disminución en la velocidad de la corriente sanguínea, éxtasis circulatorio, lentitud en las reacciones químicas que se realizan en el organismo, y como tal descenso de la temperatura; es decir, que se realizan las condiciones favorables para su vitalidad, pues sabemos que el bacillus anthracis se desarrolla

mejor en las bajas temperaturas, y en los sitios del organismo en que la corriente sanguínea lleva menos velocidad. Si á esto se agrega que siendo la bacteridia un ser aerobio, priva á los hematias del oxígeno que necesitan para sostener la vitalidad del organismo; se comprenderá que la muerte en las enfermedades carbunculosas se realiza por asfixia y por obstrucción de las últimas ramificaciones del árbol circulatorio.

El amoniaco introducido en la sangre, disminuye su plasticidad, activa los movimientos circulatorios, eleva la temperatura: de tal modo que aún negándosele su poder antiséptico, en el caso particular del carbúnculo, siempre será provechoso su empleo, porque haciendo desaparecer las circunstancias que favorecen la pululación del bacilo, dejará á los glóbulos en mejor aptitud para vencer en la lucha que tienen que emprender con el microbio, el que vencido en ella y privado del oxígeno que necesita para su subsistencia tendrá necesariamente que aniquilarse. Pero, como ya lo he dicho antes, su poder antizímico no puede negarse, y como prueba convincente de ello, basta fijarse en la rapidez de su acción. Introducir el amoniaco al organismo, y detenerse la marcha de la afección carbunculosa, todo ha sido uno en los seis casos anteriores.

En los casos en que se ha empleado el iodo ó el ácido fénico, el restablecimiento ha sido muy lento y se han necesitado fuertes dósis de medicamento, lo que no deja de tener sus peligros; pues puede causarse una intoxicación antes que se haya destruido el agente morbífico, lo que no pasa con el amoniaco. Hay, además, otra circunstancia que debe tenerse presente en los que se refiere al iodo. Este ocupa un lugar muy elevado en la escala de Miguel: el noveno; pero, según H. de Varigni (Les microbes et leur rôle pathogénique. Revue Scientiphique, Paris, 1885), el iodo en virtud de su poderosa afinidad descompone las materias albuminoideas y forma con ellas productos menos antisépticos que el iodo libre; de modo que, siendo más antiséptico que el amoniaco, pierde mucho de ese poder, una vez en la profundidad del organismo. Por lo que hace al ácido fénico es más tóxico que el amoniaco y menos antiséptico que él; en la escala de Miguel le corresponde el número 43.

El amoniaco con respecto al bacillus anthracis, reune los requisitos que deben exigirse de un agente antizímico: inocuidad para el organismo, y suficiente poder para destruir el microbio.

De todo lo anteriormente expuesto me creo autorizado para concluir que: el amoniaco es el específico de las enfermedades carbunculosas, y que debe ser el único medicamento empleado en su tratamiento, del siguiente modo:

En los casos de pústula maligna, después de la incisión depositar unas cuantas gotas de la solución oficinal de amoniaco en la herida; allí destruirá las bacterias que existan, y por su propiedad eminentemente difusible llegará al torrente circulatorio antes que el bacilo, y volverá así la sangre estéril para el microbio. Esto auxiliado por el uso interno de alguna sal amoniacal, el acetato por ejemplo. A la menor sospecha de infección general, inyección intravenosa de amoniaco.

En los casos de edema maligno y de fiebre carbunculosa, debe atacarse directamente al microbio en la sangre, el amoniaco debe introducirse al torrente circulatorio. El ataque al organismo es enérgico, y la medicación debe ser lo mismo.

FRAMBŒSIA.

By GEORGE EDMUND PIEREZ, M. D. and C. M. (Edinburgh), Antigua, West Indies.

Mr. President and Gentlemen: The following remarks upon frambœsia, or yaws, which I have the honor to lay before you to-day, are based upon some observations and a study of the disease extending over a series of years and embodied in a graduation thesis upon the subject. It was submitted to the medical faculty of

Edinburgh University in August, 1890. The disease is little known in Europe, although such renowned dermatologists as Hebra and Kaposi have described a "raspberry-like" eruption of tubercles, to which they have given the name of "framboesia;" but this disease of theirs is different altogether from that which is so frequently met with in so many of the West India islands, the west coast of Africa, and other tropical countries. It is, however, true that the real disease has been occasionally seen in England and elsewhere in patients who had brought the disease with them.[1] But there has not been much opportunity of studying it either in its earlier or later stages; and it is scarcely necessary to add that the chances of treatment have been nil. Framboesia is widely diffused throughout the tropics, and is very commonly met with in most of the West India islands. Take for examples the islands of Antigua, Nevis, and Dominica.

Antigua, according to the last census returns, has a population of 34,964, and the parish of St. Philip, to which I was appointed as Government medical officer in February, 1882, has a population of 3,065. From the date of my appointment to the end of May, 1889, I had treated 96 cases of yaws. The other parts of the island are also affected, and some of the cases which appear in the appendix to this paper have been brought to my surgery from neighboring parishes. Full statistics, however, are not to be got, as there is no hospital in the island for the isolation and treatment of the disease. I may add that framboesia is supposed to be extinguished in Antigua.[2]

Nevis has a population of 12,000. From a Royal Gazette of the Leeward Islands I copy the following notes by Dr. C. R. Edwards, medical officer in charge of the yaws hospital in that island:[3]

	1887.	1888.	1889.
Number of admissions into yaws hospital	168	117	93
Probable number of cases in the island	250	200	100
Number of daily average	22	24	24
Total cost for year	£225	£232 8s.	£219 12s. 9d.

In the island of Dominica, population 29,000, where I had been resident medical officer of the parish of St. Andrews in 1881, and where I had seen the most aggravated forms of the disease, the local legislature had found it necessary to pass a stringent act, whereby a person afflicted with yaws could be seized by specially appointed constables and sent *nolens volens* to the yaws hospital. These measures were deemed necessary owing to the extensive prevalence of the disease among the peasantry. The following are some of the sections of the Dominica yaws act, No. 17, of 1875:

SEC. XI. Every person who shall refuse to go, to be conveyed to, or shall persistently leave or run away from the district hospital before being cured, or without the permission of the medical officer in charge thereof, or who shall bathe himself, or wash his clothing at any river or stream, except at such place or places as may be appointed for such purpose by any rule or regulation herein provided to be made, shall on conviction before a police or district magistrate, on the information or complaint of a police or other constable, be liable to imprisonment for any period not exceeding ninety days.

SEC. XIII. For harboring or concealing anyone affected with "yaws," or removing one from hospital who is under treatment, without sanction of medical officer in charge, shall be liable to any penalty not exceeding £5.

Section XVI inflicted a penalty not exceeding £5 upon anyone obstructing a constable or anybody employed under the act in the execution of his duty.

[1] Liveing's Handbook on the Diagnosis of Skin Diseases, p. 238, edition of 1878.

[2] Fox's Skin Diseases, third edition, p. 100; Med. Times and Gazette, June 26, 1880; Dr. Nicholle's Third Report of Yaws Hospitals, p. 10.

[3] The Gazette is dated January 30, 1890.

The compulsory segregation of yaws patients entailed a very heavy expenditure of money, which was provided for by additional taxation, according to the terms of Section XX of the yaws act. In 1876 the yaws hospitals cost the island £775, while the extra taxation brought in £1,394. In 1877 the tax amounted to £1,428, while the hospitals spent £2,058.[1] The attention of the home office was already engaged by the importance of the subject, and Dr. Gavin Milroy was commissioned to visit the West Indies and to report upon leprosy and yaws.[2]

Definition.—Framboesia is a specific and contagious disease, existing endemically in many tropical countries. It is characterized by an eruption on certain parts of the skin consisting of solid tubercles covered by brownish-yellow crusts, and presenting a raspberry-like appearance when the crusts have been removed. The disease runs a more or less chronic course.

Synonyms.—"Framboesia" (a term introduced into medical literature by Sauvages); "pian" (of the French colonies); "lepra fungifera;" "yaws" (of West Africa and British West Indies); "toboe" (a Jamaican term for a certain phase of the disease—*vide infra*); "Scwammformige" (a German name for the disease); "polypapilloma tropicum" (so called by Charlouis, and a very suitable name it is);[3] "buba" or "boba" (of Spanish-American and Portuguese colonies and Brazil); "patch" or "bouton d'Amboine" (of the Moluccas); "tonga" or "coko" (of the Fiji Islands);[4] "framosi" (of Calabar); "tetia" (of the Congo territory); "lupani" and "tono" (of Samoa); "Peruvian wart;" "parangi" (of Ceylon).[5]

Geographical distribution.—In Africa yaws is to be met with on the west coast from Senegambia in the north, as far south as Angola, together with the westerly Soudan, where it is especially frequent in Timbuctoo and Borun. It is occasionally seen in the Nile Valley, as well as on the northern and northeastern African coast line. It is very frequently met with in Madagascar, Mozambique, and the Comoros. In the East Indies it is chiefly seen in the Moluccas, Java, Sumatra, and Macassar. It is also endemic in Ceylon, New Caledonia, Fiji, and Saoma; and it is met with in the Hindu population of Pondicherry. In the West Indies it is endemic in San Domingo, Jamaica, Barbadoes,[6] Martinique, Guadeloupe, St. Lucia, and Dominica. It is found all over Brazil, and is said to be rather frequent at Punta Arenas, in Central America.[7]

History.—The disease, though so widely spread throughout the tropics and presenting slightly different characters in different countries, has been known to Europeans only since the introduction of negro slaves into the colonies from West Africa, its original home, whence it has spread so extensively.

In 1648 Dr. William Pison described a disease he had met with in Brazil, where it attacked not only negroes but Portuguese and Belgians as well, called "buba" or "boba," and considered to be contagious and hereditary.[8] In 1718 Bontius wrote about the "bouton d'Amboine," which he saw in the Moluccas. He says it resembles syphilis, but does not cause necrosis of the bones as easily as the latter disease, and is amenable to the same treatment as syphilis if taken in hand early enough. The cause, he thinks, is to be found in the climate and mode of living. In 1742 a description of yaws, as seen in the French Antilles and there known as

[1] From the Blue Books at the Colonial office, St. Johns, Antigua.

[2] Dr. Milroy's report appeared in the Lancet, Vol. I, p. 878, *et sequitur.*

[3] Edin. Med. Journal, Nov., 1882, p. 468.

[4] *Vide* Dr. Macgregor's Report upon the Coko disease of Fiji in the Transactions of the Epidemiological Society, Vol. IV, part I, page 55.

[5] Dr. Kynsey, of Ceylon, thinks parangi and yaws one and the same disease. *Vide* Dr. Radcliffe Crocker's Diseases of the Skin, p. 531, 1888.

[6] Yaws is not supposed to be found in Barbadoes. *Vide* Fox's Skin Diseases, third edition, p. 100.

[7] Proceedings of the Royal Society of Edin., Vol. XVI, p. 301.

[8] De Medicinâ Brasiliensi, Lit. II, Cap. XIX, fol. 35.

"pian," was given by Dazille. This writer believes the disease to have been brought over by the negro slaves from West Africa. He considered it a variety of syphilis, modified by climate and racial peculiarities. In 1759 mention was made of yaws by Dr. Hillary, and his ideas upon the subject are the same as those of Dazille.[1] Dr. Winterbottom, in his account of the Native Africans of Sierra Leone, speaks of the disease, and is about the first to distinguish it from syphilis.[2] He says there can only be one attack of the disease, which is *sui generis* and very contagious. It can be communicated by coitus, when the genitals become the seat of the malady, whence arose the error of confounding it with syphilis. About the same time[3] Schilling published a work on yaws and expressed his views upon the subject. They are similar to those of Winterbottom.

In an interesting old medical treatise, published in 1749 by Dr. R. Shannon, occur the following remarks:

> The yaws is perhaps one of the most remarkable diseases that prevail among negroes. It is infectious, and like smallpox, never attacks a person a second time. It is communicated by contact, most commonly the way the venereal disease is. It is seldom caught without some connection or intimate communication.[4]

In 1860 Dr. Victor De Rochas published his thesis on the tonga of New Caledonia and the neighboring archipelago, which, he says, though closely resembling syphilis, has nothing to do with that disease, but is a variety of yaws. Among numerous others of the older writers who considered framboesia another word for syphilis, may be mentioned Sydenham, who thought that the peculiar characteristics of yaws were due to climatic influences; Dr. Copland, who makes the most astounding remark in his Dictionary of Practical Medicine, that the syphilis of Europe is derived from and hence identical with African yaws; the great dermatologist, Hebra,[5] who denies the existence of yaws as a special disease, believing it to be due to chronic ulcerations of a syphilitic, scrofulous, or lupoid origin, accidental to certain places, and proposing to call the disease "papilloma syphiliticum," or "p. scrofulosum;" and Dabny,[6] who mentions that he had met with a disease in China, having the characteristics of yaws, known as "yang-mey-tchoang," which he considered syphilitic in origin. Sprengel[7] was of the opinion that pean and yaws were two separate diseases, and Alibert[8] thought yaws was a sort of mycosis, divisible into the following three varieties: (1) "Mycosis framboise," characterized by small granular tumors which commonly attack negroes. (This is probably true yaws.) (2) Mycosis fungoide, characterized by fungous oval excrescences, exuding a fœtid discharge. (This is probably the bouton d'Amboine of Bontius.) (3) Mycosis syphiloide, characterized by its resemblance to syphilis in its symptoms. (To this variety probably belonged the "sibbens" or "sivvens" of Scotland.) This disease (sibbens) began with ulceration of the tonsils and uvula, the ulcerations bearing yaws-like tumors. But true framboesia never begins in this way, and very rarely, indeed, attacks the soft palate, if at all. I have never seen such a case as yet myself. Dr. Pollet,[9] of Lyons, thought sibbens a phase of secondary syphilis. The disease used to be met with commonly in Dumfriesshire, Galloway, and the west of Scotland, among the dissipated

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[1] The Epidemic Diseases of Barbadoes.

[2] Vol. II, published in 1770.

[3] De Morbo in Europâ Pene Ignoto quem Americani Vocant Yaws.

[4] Practical Observations on the Operation and Effects of Certain Medicines in the Prevention and Cure of Diseases to which Europeans are Subject in Hot Climates, p. 372.

[5] Traité des Maladies de la Pean, Tom. II, p. 163.

[6] La Médicine chez les Chinois, p. 263.

[7] Histoire de la Médicine, 1815.

[8] Monographie des Dermatoses, ou Précis des Maladies de la Pean, Tom. II, p. 413, 1832.

[9] Dictionaire Encyclopédique des Sciences Médicales, Vol. IV. Art.: Frambœsia.

and squalid, and it was acknowledged to be infectious.[1] Though many considered sibbens a venereal disease, others did not, and Dr. Adams thought it a malady *sui generis*.[2] Coming to more modern times, it is now generally admitted that framboesia is a disease by itself, and not in any way allied to syphilis or any other malady,[3] in spite of the belief expressed by so eminent a surgeon as Mr. Jonathan Hutchinson that "yaws is syphilis in the negro,"[4] a syphilis that in him gives rise to papillomatous growths.

Symptoms.—(*α*) Stage of incubation: The period of incubation lasts from two to ten weeks. During this stage there are no special symptoms to be recorded, excepting perhaps slight febricula in children. (*β*) Stage of invasion: Here, too, there is very little febrile disturbance, sometimes so slight that only a feeling of malaise is produced. Occasionally there are pains in the joints, and sometimes, but rarely, tenderness and enlargement of lymphatic glands, the latter being noticed only if the eruption is very extensive and the patient is weak and delicate. The eruption of tubercles is mature in from two to eight or nine days, and comes out in successive crops. The disease lasts, in mild cases, from two to four or six months, and in severe cases to two years or more.

Results.—If the disease is mild, as is usually the case in this island, no after results will follow;[5] but if it is severe and aggravated by poverty, want of cleanliness, and improper remedial measures (such as mercurials internally and the external application of various unsightly cataplasms[6]) the patients are rendered anæmic and weak, ulcerations set in, extremely difficult to heal, and death occurs from diarrhœa, or dysentery, or dropsy, or some other complication. But if recovery does take place after severe ulcerations, the patient is a cripple for life, from destruction of muscles and tendons and contractions of joints. The severer forms of the disease, though seen in some of the other islands, such as Montserrat and Dominica (where I have met with several cases myself), are not common in Antigua.

Description and varieties of eruption.—(*α*) Pian dartre. Here and there, particularly on the upper and lower extremities and the face, a branny or scurfy condition of the skin makes its appearance. Sometimes the whole body may be covered over with this furfuraceous eruption in patches of various sizes. In this stage the disease is known as "pian dartre" or "yaws cacca," and it is considered by some as a distinct variety. This, however, is a mistake, for it is but a stage in the evolution of the true tubercle. The patches, consisting of loose desquamating epithelical scales, are generally round in shape, and vary in size from that of a pea to that of half a crown, or larger, their edges being slightly elevated above the surrounding skin. On close inspection these epithelical scales may be seen to be lying over numerous, very minute elevations, which are caused by the growth and gradual protrusion of the papillæ of the skin.

Plate I is a photograph of Case CXIII (*vide* Appendix). Patches of the condition known as "pian dartre" are seen on the forearms. Some fully developed tubercles also exist, below the lower lip, on forehead and neck.

(*β*) The yaws tubercle: It varies in size from that of a millet seed to that of a florin, or larger. The greater the protrusion of the papillæ of the skin the thinner becomes the epidermis, till at last, when the tubercles have fully developed, the epidermic

[1] Brit. and Foreign Medico-Chirurg. Review, Vol. I, p. 514, 1862.

[2] Whitehead: Hereditary Diseases, p. 65.

[3] Lancet, Vol. I, p. 878; Dr. Crocker's Diseases of the Skin. Art., Framboesia.

[4] *Vide* Brit. Med. Journal, April 16, 1892, p. 815.

[5] A writer in the Edin. Med. and Surg. Journal for April, 1827, believes that elephantiasis is only a result of yaws!

[6] For softening of callosities cataplasms of cassava or warm cow dung have been used! *Op. cit.*

PLATE I.

FRAMBŒSIA.

Plate II

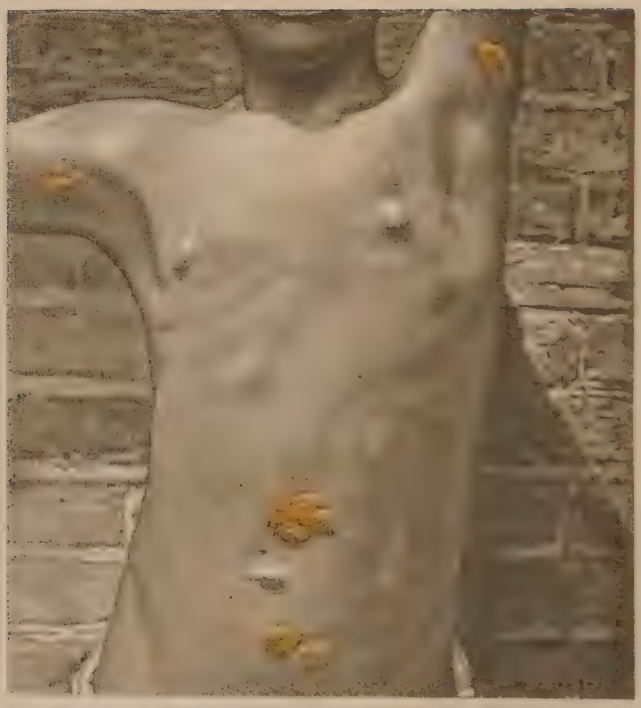

Plate III

Plate IV

Plate V

squames have nearly entirely disappeared,[1] and the surface of the excrescence presents minute, separate, but closely aggregated pink points. At this stage the tubercle is not unlike a raspberry in appearance, whence the name of the disease (from French framboise, a raspberry). Very soon this reddish granular surface becomes covered over with a sticky exudation, which dries up and forms a crust. It gets gradually thicker and forms the typical yaws crust. At the tubercle stage the body is covered over in certain parts by greenish-yellow, round or oval, raised scabs or crusts. They look not at all unlike lumps of crude yellow beeswax scattered about the body. Occasionally, by the growth of the crust in separate layers, a distinctly limpet-shell shape is produced; and those who are not properly acquainted with the disease may easily mistake this appearance, at the first glance, for rupia. The typical yaws crust is not seen on those parts of the body where there is moisture (vulva, anus), or where there is friction (inner aspect of thighs, axilla). Often small, brick-red, irregular spots or streaks are seen in a yaws crust, usually in the center or most elevated part. These reddish marks are due to hæmorrhages from the papillæ beneath. A narrow red edge of congested skin is seen immediately around each tubercle in patients of light complexion. A certain amount of symmetry in the distribution of yaws tubercles is very commonly met with, and branny patches are not infrequently seen scattered over the body in chronic cases, even when all traces of tubercles have disappeared. Sometimes two or more tubercles may coalesce, or one may grow to a very large size, while the others may remain small or disappear altogether. These large excrescences are known as "mama pian," or "mother yaws." Yaws tubercles give off a peculiar mawkish smell and are itchy but not very sensitive, except on firm pressure. This is a characteristic feature of the disease.

Plate II is a photograph on bromide paper of Case XC (*vide* Appendix). The tubercles in the axillæ have not the typical crust. A large number of small ones are seen around the larger ones. Those on the abdomen are of greater size and are covered over by the typical crust. The red patches of papillary hæmorrhages are seen on the crust. There are also visible two or three dark patches (or "maculæ") which indicate the site of former tubercles. *Cf.* Pl. XIII.

Plate III is a photograph of Case CVII. It shows the symmetrical arrangement of the eruption on the forearms. The dark spots in the center of each tubercle indicate that the healing process is commencing there. The healing of a tubercle means the shrinking to their normal level of the overgrown papillæ, and this process generally takes place in the center of a tubercle, though not invariably so. This photograph also exhibits four pigmented patches, or maculæ, on the leg, indicating the presence of former tubercles which have healed.

Plate IV is a photograph of Case CIII in the Appendix, and shows the symmetrical distribution of the eruption on the wrists and inner aspect of the elbows. There is also a yaws tubercle in the neighborhood of the right axilla.

Plate V is a photograph of Case C, and is another instance of the symmetrical distribution of yaws tubercles. One is particularly large on the left forearm, probably from coalescence of smaller tubercles. Two have almost "run" together on the right forearm. Hæmorrhagic patches and congested edges are also noticeable. The crusts, being freshly formed, are thin in substance.

(γ) Pian gratelle: This is a comparatively rare condition, and I have only seen one case to which this term might be applied. It is looked upon by some as a distinct variety. It consists of a collection of watery-looking, light purplish colored tubercles, without any distinct crust upon them, about the size of a No. 2

[1] Dr. Kynsey, of Ceylon, describes the epidermis as "splitting and curling off from the center toward the periphery." (Art. "Framboesia" in Dr. Crocker's Skin Diseases.) This applies only to the so-called variety of "crab yaws," but is not seen elsewhere in the body where the skin is thin

shot; sometimes, as in the patient I saw, one or two true yaws tubercles may be found as well. The name "Guinea-corn yaws" has also been applied to this condition, probably from the size of the tubercles.

(δ) Crab yaws: When the disease attacks the sole of the foot it is known as "crab yaws" or "crapeaux;" but this is a name applied indiscriminately to any fissured condition of the soles of the feet, a not uncommon occurrence among the negroes, and one which is due sometimes to accidental cuts from sharp stones, etc., or to the ulcerations caused by chigres or chegoes.[1] In the condition of crab yaws, a group of papillæ endeavor to force their way through the thick, horny layer of the sole, with the result that the skin cracks irregularly around the growing tubercle. It is a rawer looking tubercle than that which is found elsewhere on the body, and has no crust over it. The epidermis seems as though eaten out in irregular, more or less circular layers around the excrescence.

Plate VI is a photograph of Case XCVII in the Appendix, and is a good illustration of crab yaws. The raw-looking protrusion and the irregularly eaten out character of the epidermis around it are well exhibited.

(ε) Ringworm yaws: This is another so-called variety very frequently met with. The eruption consists of more or less circular ridges, surmounted by a layer of the usual "crust," and inclosing patches of sound skin of a distinctly darker hue than that of the rest of the body. This condition is only met with in the case of the larger tubercles, and is produced by the manner in which they heal. This process consists in the gradual shrinking of the overgrown papillæ to their natural size, the shrinking sometimes beginning in the center of a tubercle and spreading toward the periphery, thus producing the ringworm-like appearance, at other times beginning at one side of a tubercle and gradually spreading across it, giving rise to yet another variety of yaws, the so-called "lupoid" of S. Kynsey.[2] When the yaws crusts drop off there is no cicatrix left to show the site of the tubercles but only darkly pigmented patches or maculæ, the degree or intensity of pigmentation depending upon the complexion of the person attacked. These maculæ, which may be seen scattered over the body along with other stages of the eruption,[3] may last for two months or more, but seldom disappear entirely even then. I have known them to last over a year.

Duration and termination.—It may take from two weeks to four or six months or even longer for the first crop of tubercles to disappear. Then fresh eruptions may come out and fade away in the same way, and a patient may go on thus for one or two years or longer, and eventually get quite well without any special treatment or any perceptible deterioration of health beyond, perhaps, inability to walk from the disease having attacked the feet (crab yaws). But, on the other hand, from long continuance of the disease and injudicious treatment the tubercles, instead of shrinking and disappearing, are apt to break down and ulcerate. The injudicious treatment consists in the application of poultices of crushed leaves of various kinds to the tubercles, in which, in spite of their too often seen evil results, the negroes have an undying faith. This, with neglect of cleanliness and the use of unwholesome food, impoverishes the system and renders it liable to ulceration.

Yaws ulcers are generally round and vary from the size of a 3-pence piece to that of a half-crown, or more. In Dominica I have seen yaws ulcers on the anterior aspect of the legs, their commonest position, exposing a raw surface of 3 or 4 square inches. They are punched-out looking, their edges round and hard but not swollen, and their surface slightly granular and bright red. These ulcers are said to cause necrosis of bone, but I have never seen anything so severe in Antigua.

[1] The chigre is the female of pulex penetrans, which burrows beneath the skin and lays its eggs there. Great irritation and often ulcerations are the result to the host.

[2] Crocker's Skin Diseases; Art. "Frambœsia."

[3] *Vide* Plate III, where maculæ exist on the leg and fully developed tubercles on the forearms.

Plate VI

Plate VII

Plate VIII

Plate IX

PLATE XI.

FRAMBŒSIA.

PLATE XII.

FRAMBŒSIA.

Plate XIII

The following plate is a very good illustration of the ordinary form of yaws ulcers:

Plate VII, a bromide print, colored, of Case XCVIII. It will be noticed that there is symmetry in the site even of the ulcers. The black spots are maculæ.

Distribution of eruption.—The most common seats of the eruption are the upper and lower extremities, but chiefly the latter. Broadly speaking, those regions are least attacked that are best protected by clothing. The face, the angles of the mouth, the root of the nose, and the forehead are other favorite seats of yaws tubercles and they are frequently seen around the anus and on the genitals.

Plate VIII is a photograph of Case CXIV, showing the eruption at the angle of the mouth, as well as over the rest of the face. Some tubercles are also seen on the forearm.

The following is a photograph of Case CVIII in the Appendix. The eruption on the forehead has a somewhat serpiginous character. There are numerous small tubercles on the cheek and a large oval one on the side of the neck. The hæmorrhagic patches on the crust were well marked in this case.

Plate X is a water-color sketch of Case II. This was a mulatto lad. The tubercle on the scrotum was very large. I found no enlargement of the inguinal glands. The congested border of skin on the edge of the tubercle was well marked, as were also the hæmorrhagic points in the crust.

Although the eruption is said to occur on the hairy scalp, the interior of the mouth, and the palms of the hands, I must confess that I have never seen an example of any of them.[1]

The following table of 116 cases of yaws treated by me in the island of Antigua up to the end of May, 1889, will show the relative frequency of the seat of eruption of yaws tubercles:

	Cases.		Cases.
Face	15	Genitals and perineum	7
Upper extremities	32	Universally diffused	9
Lower extremities	48		
Trunk	5	Total	116

For the sake of comparison I append the following table from Dr. Nicholls's Third Report of Yaws Hospitals to illustrate the chief seats of distribution of yaws eruptions:

	Cases.		Cases.
Face and head	49	Upper extremity	29
Trunk	20	Lower extremity	70
Genitals	16		
Perineum	20	Total	204

Dr. Nicholls has seen tubercles on the scalp in only three out of the above cases, but not once in the axilla. In my own experience I have never seen the eruption on the scalp, but have often met with tubercles in the axillary region. See Plates II and IV.

The following plates are front and back views of Case CIV. They are good illustrations of a diffuse distribution of the yaws eruption. It is to be noticed in this photograph again that there is a symmetrical arrangement of the eruption.

Plate XIII is a life-size photograph of the yaws tubercles on the trunk of the young man, Charles Spencer, Case XC in the Appendix. (For another photograph of the same, see Pl. II.) The irregular and pitted condition of the surface of the crusts is indicative of its age, for when freshly formed it is smooth. (*Vide* Pl. V.) Numerous small excrescences are seen around the larger ones. These large tubercles are sometimes called "mother yaws."

[1] The only exception of a palmar site of a yaws tubercle I have seen was in the case of Frances Bowers, *vide* Appendix, case No. 134.

Age and sex.—Both sexes are equally attacked by the disease. Of 116 cases seen by me 57 were males and 59 females, and of 100 cases referred to by Dr. Nicholls[1] 58 were males and 42 females. Age, however, has a predisposing influence in the production of yaws, for the young are more easily affected than adults. The following table shows the ages and the relative frequency of attacks in 116 cases:

	Cases.		Cases.
1 year and under	7	Over 20 years	13
Between 1 and 5 years	49		
Between 5 and 10 years	31	Total	116
Between 10 and 20 years	16		

The following analysis of 466 cases is given by Dr. Nicholls:[2]

	Cases.		Cases.
Under 5 years	82	20 years and under 30	49
5 years and under 10	142	30 years and upward	74
10 years and under 15	82		
15 years and under 20	37	Total	466

Diagnosis.—(α) psoriasis and the condition known as "pian dartre:" In the latter there is no inflammatory thickening of the skin, with redness, such as exists in psoriasis. Again, the seat of psoriasis patches is typical of that disease, viz., the elbow and knee below the patella; there is no such predilection for any particular spot of the body in the case of pian dartre. Psoriasis patches are itchy and irritable; pian dartre is not. Lastly, there often exists with pian dartre other forms or stages of the yaws eruption (such as tubercles) to indicate the true nature of the disease.

(β) Eczema squamosum and pian dartre: In the former disease there are often other varieties coëxisting with the squamous condition, such as the weeping form, which will be sufficient to distinguish the two maladies.

(γ) Yaws and syphilis: So much doubt has prevailed, even up to recent times,[3] with regard to these two diseases, that a few words must be devoted to the differential diagnosis between them. It is now generally held that the two are entirely distinct; but there were many, whose names are too familiar in medical literature, who have been of opinion that yaws was really syphilis modified by climate and racial peculiarities (Dazille, Sydenham, Copland, Kaposi, and, coming to recent times, Jonathan Hutchinson). Some of the chief points of difference between the two diseases are the following: (1) Syphilis has a predilection chiefly for mucous surfaces; yaws chiefly affects the skin. (2) The lymphatic glands are always enlarged in syphilis; in yaws this is seldom seen, except in severe cases with debilitated constitutions. If the eruption was of syphilitic origin in Case II, vide Pl. x, the inguinal glands would most assuredly have been enlarged; but I have made the remark that these glands were not enlarged. (3) Syphilitic eruptions are not itchy; yaws tubercles are. (4) A coppery color is characteristic of syphilitic eruptions; the crust is distinctive of yaws tubercles. (5) A chancre or indurated sore always occurs at the spot of inoculation with syphilitic virus; whereas in yaws the eruption breaks out not necessarily at the site of inoculation, but elsewhere on the body. (6) Syphilis causes necrosis of bones; yaws never does, except as a result of chronic ulcerations. (7) A patient suffering from secondaries can not contract an indurated sore; but a patient with yaws poison already in his system can have on a healthy part of his skin fresh tubercles by inoculation of that part with yaws virus. This was found out in 1867 by Dr. Gama Lobo, of Brazil.[4] (8) Yaws is more common in young children, but not as a congenital disease. Very commonly the parents are perfectly healthy and clean

[1] Third Report of Yaws Hospitals.

[2] *Op. cit.*

[3] *Vide* Brit. Med. Journal, April 16, 1892, p. 815.

[4] Dictionnaire Encyclopédique des Sciences Médicales, Art. "Framboesia."

skinned, while the child may have yaws tubercles. Again, only one child might be affected in a family of three or four. If yaws was syphilis more than one at least would be diseased. (9) Lastly, and this is most positive proof of the non-identity of the two diseases, if such were really needed, syphilis and yaws have coëxisted together, each running its own course and displaying its own characteristics. Such a case was seen by Dr. Gavin Milroy in the public hospital of Kingston, Jamaica.[1] Charlouis,[2] surgeon to the Dutch army in Java, inoculated a patient suffering from framboesia with syphilitic virus. The result was that a typical case of syphilis was produced, which did not affect the course of the framboesia.

Prognosis.—In otherwise healthy children or adults the disease is not grave, and needs no special treatment beyond cleanliness and wholesome food. Successive crops of the eruption may come out from time to time, and the skin may get quite free from tubercles in from one to six months. So little is thought of the disease by the negroes themselves, who are the chief sufferers, and who generally use their own tisanes and cataplasms in the treatment of the disorder, that healthy children have been known to have been specially inoculated with yaws by their mothers as a prophylactic measure against other and more serious maladies. This fact came within the personal knowledge of the late Dr. B. Johnson, of Montserrat, as having really taken place there; and the late Sir John Gorrie informed me that it was a common practice with the natives of the Fiji Islands. In the older days of slavery mothers used to give their children yaws, not to protect them against other diseases, but as an excuse from doing work on the estates, the afflicted children needing all maternal care and attendance at home.[3] The prognosis is not, however, so favorable in those who are already of delicate constitution or the subjects of the scrofulous diathesis. For here the patients become thin and anæmic, and the "tubercles," instead of gradually shrinking and fading away as is generally the case, are apt to break down and ulcerate. Deeper structures, as muscle, tendon, and bone, may then be involved, giving rise to deformities of various kinds, or death may result from some intercurrent affection, as diarrhœa or dysentery or dropsy.

Etiology.—( ) Predisposing causes: (1) Race. It is generally believed that yaws attacks only the negro, or black race. This, however, is an erroneous impression, although most of the cases met with occur among the negroes; for to whomsoever the virus is applied, especially if the cuticle is broken, be he black or white, the disease will manifest itself in due course. It is chiefly the poorer class of negroes who are affected, those who are generally dirty in their habits, poorly clad, and badly fed and housed. They are thus more exposed to the contagion. The mulatto population of these islands are, as a rule, better off, and are more cleanly and intelligent; thus the chances of contagion in their case are greatly reduced, while in the case of the whites the risk of contracting the disease is reduced to a minimum. The following is an analysis of 116 cases, and exemplifies the relative frequency of the disease in different races:

	Cases.
Black (negroes)	105
Colored (mulattoes)	9
White (Portuguese)	2

That the disease was not peculiar to negroes alone was noticed by Dr. Shannon,[4]

[1] *Vide* Med. Times and Gazette, Vol. II, p. 515.

[2] Edin. Med. and Surg. Journal, November, 1882, p. 468.

[3] A mention of this dodge having been practiced in St. Kitts is to be found in an old book, published in 1801 (p. 158), called "Letters on the Cultivation of the Otaheite Cane, the Manufacture of Sugar and Rum, the Saving of Molasses, the Care and Preservation of Stock, with the Attention and Anxiety which is due to Negroes," by Clement Caines, Esq.

[4] Practical Observations on the Operation and Effects of Certain Medicines in the Prevention and Cure of Diseases to which Europeans are Subject in Hot Climates, p. 380.

who says: "Several of the soldiers were affected by it," and further on[1] "yaws is frequently contracted by the European sailors in the slave trade." A former governor of this colony, the late Sir ———, informed me himself that he had had an attack of yaws while serving on the west coast of Africa. I may remark that in my two white patients the eruptions presented the very same appearances as those already described as occurring in the negro. Mr. Jonathan Hutchinson's syphilitic origin of yaws, with tendency to papillomatous growths, in the negro will hardly hold in white races. The theory needs remodeling on very different lines.

(2) Food: Some of the older writers believed that yaws arose from the use of bad food (such as semiputrid meat or fish), and from insanitary surroundings and dirt. But these conditions act as predisposing causes only by lowering the vitality of the individual.

(β) True cause: Yaws is a contagious disease, depending for its spread upon the presence of a specific virus, a microbe. It is not hereditary or infectious. Inoculation may take place by application of the poison to such thin skin as exists on the lips or genitals; hence, it is often spread by sexual intercourse and by diseased mothers to their children at the breast.[2] It may also be produced in a position where the skin is thicker. For instance, Dr. Bowerbank, of Jamaica, painted the inner aspect of the arms of three young girls for a few minutes during two days with a feather wet with yaws virus, and the disease appeared on them on the twentieth day.[3] But the disease occurs all the more readily and surely if there is any abrasion of the cuticle, and flies[4] may thus become the medium of infection and cause the spread of the disease, though there may be no actual contact of the healthy with the diseased. Dr. Gavin Milroy, in his Report on Leprosy and Yaws, submitted to the secretary of state for the colonies, made a statement to the effect that he thought yaws under certain conditions contagious, by contact of the healthy with the diseased, but that he did not believe contagion to be the sole cause of the spread of the disease amongst a community. He mentions the fact, given by Dr. Crane, of Trinidad, that patients suffering from yaws were admitted into the general hospital of that island and that nevertheless there was no spread of the disease amongst the inmates of the institution. On the other hand, however, Dr. Espinet, also of Trinidad, says that a case of yaws was admitted into the leper asylum of that island and that several cases had arisen after it.[5] But does the mere fact of there being no spread of yaws in the Trinidad general hospital, after admission therein of an infected case, either prove or disprove the theory of contagion? Surely not. Unless there be inoculation of the system, either directly by contact or indirectly by flies, or other means, with the "materies morbi," no result will follow, and I hold that Dr. Gavin Milroy's statements are founded upon insufficient observations. As proof of contagion from nursing mother to child, I give the following cases from the Appendix:

Case XLIX.—Margaret Henry, æt. 35 years, negro, from the village of Willikies, in this island, came to my surgery on June 13, 1885, with yaws eruptions on forearms, legs, face, and breasts. She had noticed them since the end of the previous month.

Case XLVIII.—Louisa Thomas, æt. 1 year, illegitimate child of the above, was brought to me on the same day (June 13) by its mother, who said the child showed the disease on June 8. It had been perfectly healthy before. On examination I found yaws tubercles at the angles of the mouth and on the cheeks.

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[1] *Op. cit.*, p. 557.

[2] Edin. Med. and Surg. Journal, April, 1827. Also compare my cases 48 and 49, *infra*.

[3] Dictionnaire Encyclopédique des Sciences Médicales, Vol. IV., art.: Frambœsia.

[4] *Vide* Crocker's Skin Diseases.

[5] Dr. Nicholls's paper in Med. Times and Gazette, January 3, 1880.

The following cases from the Appendix are given as exhibiting proofs of contagion by direct contact:

Case LIV.—Mrs. Gilead, æt. about 35 years, negro laborer, from the village of Newfield, Antigua, came to see me on September 24, 1885. She had yaws tubercels on forehead, arms, and legs, with some maculæ as well. She had noticed the eruption about a week previously. She could not say where she had contracted the disease, but one of her children had had it up to the end of July, 1885.[1]

Case LVII.—Edward Gilead, æt. 50 years, negro laborer, husband of Case LIV, from Newfield village, came to my surgery on October 12, 1885, with yaws tubercles on forehead, angles of the mouth, arms, and legs. He had noticed them on the 5th of October, and is sure he had contracted the disease from his wife.

Case LV.—Edgar George, 10 months, illegitimate son of Mary Adams, negro laborer, from Willikies village, was brought to me on October 4, 1885, suffering from yaws of two days' duration. Mother could not say where her child had got the disease, though the disease was prevalent in the village at the time. By the third week of December the child was perfectly well, only a few maculæ being seen.

Case LXVIII.—Mary Adams, mother of the above, came to me on January 3, 1886, with well-marked yaws eruptions on arms, legs, and buttocks. She said she had had them for about two weeks previously (that is, about the 20th of December). The child had always slept with her and she had been nursing him, and she is sure she had caught the disorder from him, as she had not seen or come in contact with anybody else suffering from the disease.

Case LXXII.—Archibald Philo, æt. 5 years, negro, from Betty's Hope estate, was brought to my surgery on August 10, 1886, with yaws eruptions on face, arms, legs, and buttocks. He was all right by the end of the month.

Case LXXIII.—Beatrice Philo, æt. 6 years, sister of the above, was brought to me on September 6, 1886, with yaws tubercles on face, arms, legs, and genitals. She was quite well by end of October. She had always slept with her brother, and the mother did not think there were any other cases of the disease on the estate.

Case LVIII.—Eleanor Thomas, æt. 3 years, illegitimate child of Sarah Bartley, from Freetown village, was brought to me on October 18, 1885, with yaws eruption on arms, legs, genitals, and anus. She had had the disease since the middle of September, 1885. The mother could give no history of contagion. She was well by the 7th of December, 1885.

Case LIX.—Susanna Thomas, æt. 4 years, sister of the above, came to see me on the same day with an almost identical distribution of the eruption. The mother had noticed Susanna's spots on the arms and legs at the end of September, and said that the two children always slept together.

Case CVI.—Catherine Richards, æt. 16 years, negro, from Liberta Village, came to me on January 17, 1889, with the disease well marked on face, arms, and legs. She had had it four months previously.

Case CXIII.—Henrietta Richards, æt. 12 years, a sister of the above, came to consult me on February 9, 1889. She had had yaws two weeks previously and had always slept with Catherine, to which fact she attributed her own illness, as she had not come across anybody else in the village with the disease.

Case CIX.—Lucy Rodish, æt. 10 years, a Portuguese girl of unmixed blood, from the village of Sweets, was brought to me on February 6, 1889. She had a typical yaws eruption on arms, shoulders, and legs. Her mother had noticed it a few days before.

Case CXV.—Caroline Rodish, æt. 15 years, sister of the above, came to my surgery on May 15, 1889. The mother had noticed the eruption first upon the arms about the middle of April. At the time of her visit to me the eruption was a general one all over the body. The two sisters were always together, and were in the habit of occupying the same bed. I may mention that the eruption in these two white cases (as well as in another, Case CXVIII in the Appendix) presented identically the same characteristics as those observed in negroes.

Case CXVI.—Eliza Bailey, a colored girl (mulatto), æt. 8 years, also from the village of Sweets, was brought to me on May 15, 1889, by her mother, who is a Government midwife and an intelligent woman. She says Eliza first had the tubercles toward the end of February, 1889, that she was a great friend of Lucy Rodish (Case CIX *supra*), and that she was sure her daughter had contracted the disease from her playmate.

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[1] *Vide* Case XLVI, in the Appendix.

Immunity from second attacks.—A great many writers have expressed the opinion that there can only be one attack of the disease. Among these may be mentioned Winterbottom,[1] Schilling:[2] and Shannon,[3] who says "it is infectious, and like smallpox never attacks a person a second time"; Liveing,[4] who writes, "One attack is believed to afford decided protection against a second inoculation, but the affection is very liable to relapse;" Dr. Paulet, who inoculated five times negroes who had been thoroughly cured of the disease but failed to produce a second attack in them;[5] the late Dr. Imray, of Dominica; Dr. Rankine,[6] and many others. Others again hold that a second attack may occur after a patient has had yaws and has gotten quite well from it (Drs. Bowerbank, of Jamaica, and Nicholls, of Dominica).[7] For myself, I must own that I am somewhat in doubt as to the absolute correctness of these second attacks; I am more inclined to look upon them as relapses. The following are examples from my list of relapses:

Case IX.—Bobby Thwaites, æt. 6 years, from the village of Willikies, was first brought to me for treatment on November 10, 1882. He was quite well by end of December. On April 30, 1883, fresh tubercles were noticed on his body. He was well again by the middle of May.

Case LXVI.—Samuel Lawrence, æt. 4 years, from the village of Seatons, was first treated by me for well-marked yaws of three weeks' duration on December 16, 1885. By the end of March, 1886, he was quite well. In the middle of August, about four and one-half months after his recovery, he was brought back to me with a fresh attack of the disease.

Cases XXXI and CXXVIII in the Appendix are other cases of relapse. Dr. Nicholls[8] gives short summaries of the histories of a few of his cases of reinoculations. In one of these (case 480) the patient was perfectly well for ten and one-half months, and then he contracted the disease again; in another (case 356) eleven months of health intervened between the first and second attacks. While at the Prince Rupert's Hospital he noticed second attacks coming on a year or two years after the first attacks were got rid of.[9] Although I look upon my own cases as examples of relapses, still the instances given by Dr. Nicholls have the appearance rather of fresh inoculations. I have found it impossible in my own cases to trace the source of reinfection, except it lay in the yaws crust. The crust contains the inoculable virus, and is easily rubbed off or may fall off when dry, often without the patient's knowledge. These fresh attacks, then, may arise from the crusts adhering to the clothes or lying on the dusty, dirty, and too-often unboarded and uncovered floors of the huts, where the naked negro child is always to be seen sprawling.

Pathology.—Whether there are lesions to be found in the internal organs, such as the liver or spleen, in cases of yaws I am not able to state from personal knowledge, never having had the opportunity of holding post-mortem examinations in such cases. But Van Leent, of Batavia,[10] states that the lymphatics are dilated and the glands engorged, sometimes containing purulent fluid. He has seen caseous deposits in the lungs, kidneys, liver, and spleen, and also in the muscles.

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[1] Account of Native Africans of Sierra Leone, Vol. II.

[2] De Morbo in Europâ Pene Ignoto quem Americani Vocant Yaws.

[3] Practical Observations on the Operation and Effects of Certain Medicines in the Prevention and Cure of Diseases to which Europeans are Subject in Hot Climates, by R. Shannon, M. D., published in 1794.

[4] Skin Diseases, p. 237, 1878.

[5] Dictionnaire Encyclopédique des Sciences Médicales. Art. "Frambœsia."

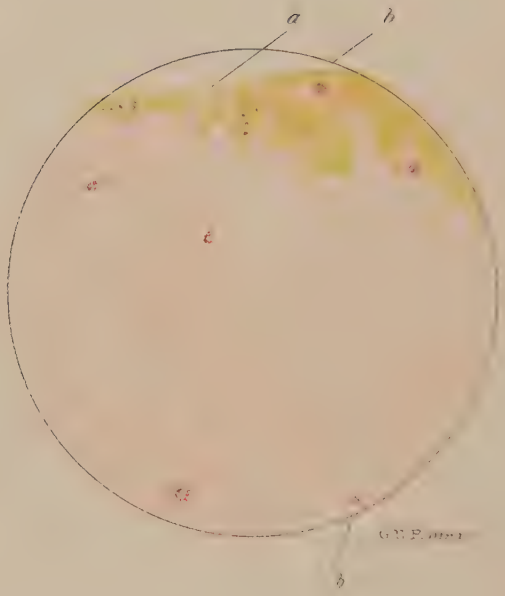
[6] Edinburgh Medical Journal, April, 1827.

[7] Charlouis, of Batavia, is also a believer in second attacks, *vide* Edin. Med. Journal, November, 1882, p. 468.

[8] Fourth Report on Yaws Hospitals, Appendix B, p. 23

[9] *Op. cit.*, p. 10.

[10] Diction. Encyclop. des Sciences Med., Vol. IV. Art. "Frambœsia."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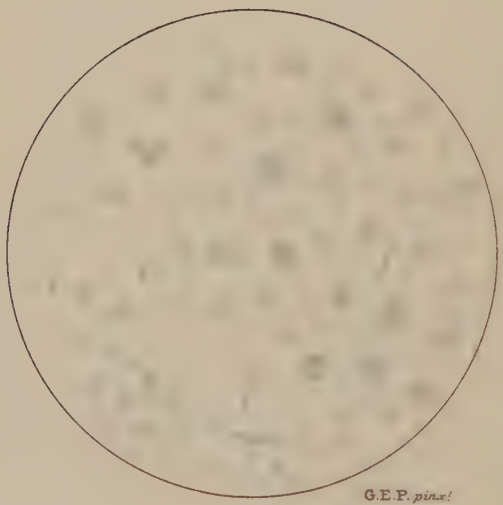

G.E.P. *pinxt*

Plate XVII

cartilages, ligaments, and bones. With regard to the minute structure of a yaws tubercle, it may be stated that it consists essentially of a dermatitis affecting the horny and mucous layers and the papillary stratum. The following is a vertical section of a tubercle as seen under a low power (Leitz, Ocular 2, Obj. 3); it was stained with alum carmine.

Plate XIV. The papillæ are enlarged and elongated. Large numbers of leucocytes are finding their way through the epidermis to the surface of the skin. There is also seen an abundant proliferation of cells and a good deal of organized tissue spreading upward through the horny layer. This organized tissue consists of delicate fibrils issuing from the rete Malpighii, crossing and intercrossing each other, and often inclosing patches of epithelial squamæ. This organized new tissue is highly vascular, and may be seen in two or three places to pierce the epidermis and to lie over and cover it. (*Vide a* in plate.) Several blood vessels seen cut across (*b* in plate). Under a high power numerous micrococci are seen scattered throughout the substance of the tubercle, but chiefly in the upper layers of the dermis. Along the surface of the epidermis and stretching below it are seen large numbers of micrococci, many being contained within leucocytes. These coccus forms are especially abundant in the large cells found at the junction of the horny layer with the rete Malpighii, or the layer of Laugerhaus. Many of these cells are quite full of micrococci. (*Vide* plate.)

Plate XV is a vertical section of a yaws tubercle, stained with methyl blue, and decolorized with solution of iodine and iodide of potassium. (Leitz, Oc. 3, Obj. 7.) (α) leucocytes, (β) micrococci.

Bacteriology.—A bit of yaws crust was teased out in distilled water, treated as a cover-glass specimen, and stained in methyl blue. (See Pl. XVI.) Leitz, Oc. 3, Obj. 7, numerous bacilli seen singly and in twos or threes, the single rods measuring about 2 μ in length and about 0.5 μ in breadth. Large numbers of leucocytes also visible, and micrococci and bacteria. On inoculating a tube of sterile beef broth with the solution of yaws crust in distilled water a cloudiness was produced in two days, and a film was seen on the surface. They both gradually became of an amber color. Under the microscope crowds of vigorously motile bacilli were visible singly, in short chains, and in long leptothrix threads. The single rods were of the same size as those already referred to in the fresh specimen. A sterile tube of nutrient jelly was next inoculated from the broth. In two days a cloudiness appeared in the track of the needle. Microscopically the same appearances were observed as in the case of the broth. (*Vide* plate.)

Plate XVII is an artificial culture of yaws crust in sterile nutrient jelly, magenta staining. (Leitz, Oc. 3, Obj. 7.)

I may mention that the jelly was rendered slightly diffluent at the end of three weeks' growth. On examining the jelly microscopically, four days after plate 17 was painted, I found very few bacilli, but in their stead countless myriads of shining oval spores, measuring about 1 μ in length and 0.5 μ in breadth. The few bacilli visible were seen to contain oval, shining spores. These bacilli were never seen by me in the substance of the tumor; they were absent from yaws crusts that were protected by clothing. They are only found in old and exposed crusts. I have therefore come to the conclusion that they are contaminations, and are of the nature of the ordinary bacillus subtilis. A drop of blood was taken from the finger of a patient suffering from yaws (not close to any eruption), the surface of the finger having been previously sterilized. The specimen was dried on a cover glass and stained with magenta. Numerous coccus forms were seen scattered about the field (*vide* Pl. XVIII) amongst the red blood corpuscles, some of them adhering to the cells. These micrococci vary in size from 0.3 μ or 0.4 μ to nearly 1 μ in diameter.

Plate XVIII is a cover-glass specimen of blood of yaws patient, magenta staining. (*a*) White corpuscle; (*b*) red cells; (*c*) micrococci. (Leitz, Oc. 3; Obj. 7.)

With the usual antiseptic precautions a tube of sterile beef broth was inoculated with the blood of the same patient. In three days the broth was found turbid; there was no pellicle formed on the surface. This proved that the growth belonged to Pasteur's anaërobic group of microörganisms. Under the microscope a luxuriant crop of micrococci was seen, singly, in twos (diplococci), and in small clusters. They were of the same size as those described in Plate XVIII. From this tube a second of sterile, solidified hydrocele fluid was inoculated. In three days a cloudiness appeared in the track of the stab, and the jelly was rendered slightly diffluent on the surface. A week after the jelly was more fluid on the top. The grayish-looking opacity that the microörganisms first presented gradually gave way to a salmon color. Microscopically, the growth presented the same appearances as that already described in the broth tube. A scraping from a patch of pian dartre was next stained and examined. In it were found a large number of coccus forms, of the same size as those already described, singly, in twos, and in small clusters, many of them being seen adherent to the epithelial scales of which the scraping consisted. There were also a few bacilli, which on artificial culture were found to be identical with those already described (and figured in Plate XVII).

Inoculation experiments.—With the artificial culture of the bacilli in the crust I made several inoculations on animals (fowl, dog, cat), but without any result whatever. I also tried it on my own person, without any effect. With the artificial culture of the micrococci from the blood of my yaws patient, I repeated the inoculation experiments I had previously tried with the bacilli. There were no results in the case of the fowl or dog, but there was success with the cat. I used the inner aspect of the left ear for inoculation. After the expiration of three weeks I noticed a small swelling on the upper or outer aspect of the right ear, which daily enlarged and in a few days presented the unmistakable appearance of a yaws tubercle. There was also one on the face, over the nose, but none of them showed any crusts, probably from the hairy nature of the site.[1] I also inoculated myself with the micrococcus culture, but beyond the fact that the site of inoculation was itchy, red, and slightly swollen for about a fortnight after the operation, there was no result. From the above-detailed experiments, I have come to the conclusion that the bacilli found in the crusts are contaminations from without, and allied to bacillus subtilis, and that the true cause of the disease yaws is a micrococcus, which I took the liberty of christening the micrococcus framboesiæ in my "graduation thesis," submitted to the medical faculty of Edinburgh University in August, 1890.

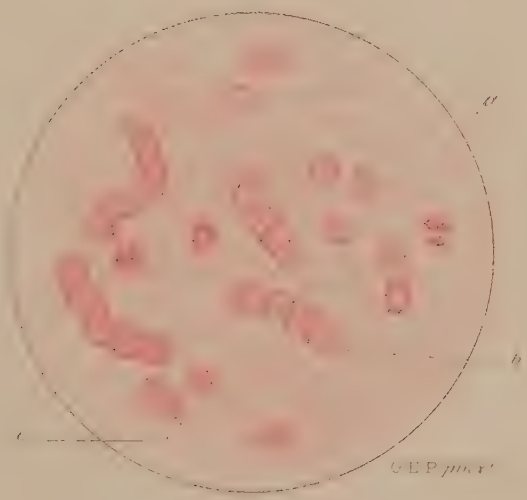
Treatment.—In mild cases of the disease very little need be done. Indeed, the physician is seldom consulted except when all home remedies have failed, and the patients begin to show signs of debility from long duration of the malady, or when ulcerations break out too stubborn to be managed by the natives themselves. If the patient gets a good diet, and if, particularly, he is kept clean, the disease will run a course of from two to four months and entirely disappear. Dr. Shannon[2] says:

> If a negro that has contracted the disorder be put in circumstances favorable to general health; if he be not obliged to work; if he be allowed a good diet; and if he be kept clean by constant washing it will run its course and after a time disappear entirely. * * * The African negroes cure yaws and the venereal disease

[1] I may mention that these tubercles lasted for two weeks, and when they disappeared two bald patches were left behind.

[2] Pract. Observations on the Operations and Effects of Certain Medicines in the Prevention and Cure of Diseases to which Europeans are Subject in Hot Climates, by R. Shannon, M. D., p. 380.

Plate XVIII



by sea bathing and promoting the perspiration by drinking plentifully of a decoction of camwood[1] sharpened with sour palm wine, and at other times with lime or lemon juice.

In some of the West India Islands, such as Dominica[2] and Jamaica[3] the negroes are in the habit of using mercurials internally, up to the point of salivation, with sarsaparilla. This had the effect of producing anæmia and debility. But in Antigua this treatment is not in vogue, the only remedies in use being the external application to the eruption of blue stone, or verdigris, or indigo, or lime juice, or the irritating sap of the "dagger,"[4] combined with the internal use of tisaneo, or decoctions of sour-sop[5] leaves, or vervain,[6] or other equally harmless plants. Before the abolition of slavery mild cases of yaws were always treated by some of the old women upon the sugar estates, who were supposed to know the secret of curing the disease. These sages were known as "yaws grandies." But there was also great care taken of the slaves by the proprietors in some of the islands, as Jamaica,[7] for instance; for many estates had yaws hospitals, where patients were isolated and properly treated and cared for. The following is the treatment I have pursued in my practice:

(α) *Mild cases.*—Here I only use the external application of a mild germicide ointment, as the red oxide of mercury (5 grs. to ℥i of adeps). The patient should be well washed with plenty of soap and water. the crusts removed when softened, and the ointment should be well rubbed over every tubercle. The patients, generally children, should not be allowed to dabble in dust and dirt, and not be permitted to play with healthy children. This simple treatment I have found most successful in all mild cases.

(β) *More severe cases.*—Here, besides the external application of the same ointment recommended in class α, I have been in the habit of giving arsenic and iron, gradually increasing the doses of the former, with great benefit.

(γ) *Severe cases.*—These patients are always emaciated and anæmic, and have to be put upon a tonic treatment at once. I generally combine sulphate of quinine with the iron and arsenic mixture, and I do not hesitate to increase the arsenic. I also increase the strength of the ointment I have recommended by using 10 or 15 grains of the red oxide of mercury to ℥i of adeps. I sometimes use Tr. iodi. (P. B.) in this class as an external remedy when I find the ointment inefficacious.

(δ) *Ulcerations.*—These are very stubborn to manage, and if tonics are indicated in class γ they are more so here. If tubercles coëxist with ulcers they should be treated as suggested in class γ. The ulcers are treated by the application to them once every second day of a solution of chloride of zinc (20 grains to ℥i aqua), an ointment of zinc oxide or iodoform being applied on lint in the intervals. If this treatment fails the ulcers should be painted once a day with the strong tincture of iodine (Edin. Ph.) or the liniment of iodine, and then tightly strapped with strips of emplastrum resinæ in such a manner that the edges of the ulcers may be approximated.

(ε) *Crab yaws.*—This condition I have known to last longer than any other form of the disease, simply because of the unfortunate position of the tubercles, rest and cleanliness being almost impossible of attainment in the particular class of patients under consideration, except in hospital practice. A strong solution of zinc chloride (30 grains to the ounce) should be applied with a brush to the tubercles three times a week, an ointment of zinc oxide, or iodoform, or resorcin

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[1] A leguminous plant, caphia nitida, which produces a red dye.

[2] Dr. Nicholls's Third Report of Yaws Hospitals, p. 12.

[3] Dr. Bowerbank, quoted by Nicholls, *op. cit.*

[4] Art: "Fourcroya."

[5] Anona muricata.

[6] Verbena Jamaciensis

[7] Report on Leprosy, by the Royal College of Physicians, 1867, p. 12.

being applied in the intervals. I can confidently recommend this form of treatment, but it must be remembered that no form of treatment will be of any avail in these cases unless there are absolute rest and cleanliness of the parts. The peculiar eaten-out-looking patches on the soles of the feet remain long after every other trace of the disease has disappeared, and serve as a proof of an antecedent attack of yaws. In many of my adult cases rheumatic pains in the joints were complained of after the disappearance of yaws. Here iodide of potassium has done good. Besides arsenic and iron as general blood tonics and a good diet, cod-liver oil is of benefit, especially in weakly children. In several of my cases I have tried chaulmoogra oil, both externally and internally, as well as gurjon oil externally, but I have not found them of any use. With regard to the internal administration of mercurials, I can not say that I can approve of it, although recommended by several writers. I have never seen any necessity for its use, all my patients having been easily enough cured by the treatment that I have recommended.

Classification.—In Fox's Diseases of the Skin,[1] yaws is placed under the head of the exanthemata, but somewhat doubtfully; and in the Medical Times and Gazette,[2] Dr. Gavin Milroy says that the disease belongs to Cullen's class of cachexiæ, or "those diseases which consist in a depraved state of the whole or of a considerable part of the habit of the body, without any primary pyrexia or neurosis combined with that state." In the Nomenclature of Diseases, by the Royal College of Physicians, yaws is placed in class D of the following table:[3]

General diseases.

	(A) Diseases dependent on morbid poisons (specific febrile disorders).
Diseases dependent on external agents.	(B) Diseases dependent on external agents other than morbid poisons (as animal and vegetable parasites, etc.).
	(C) Developmental diseases.
	(D) Not classified (yaws-parangi.)

Dr. Liveing[4] thinks it is a general constitutional disease, and classes it with dermato-syphilis and elephantiasis Græcorum; and one of the recent treatises[5] on skin diseases has yaws classified under neoplasmata, or new growths—a wise classification, in that it avoids all theories and doubts. With regard to the propriety of placing framboesia under the head of "cachexiæ," I have no doubt in my mind that there are no just reasons for doing so. A cachectic condition is not characteristic of yaws, and is only seen exceptionally in those patients who have been ailing very long, or who are the subjects of ulceration. When once framboesia has been perfectly cured there occurs no sequelæ, and the system is again thoroughly restored to health. Besides, there is no suspicion of a hereditary tendency to the disease. I therefore do not look upon it as a constitutional disease to be classed with syphilis or leprosy. It is a disease caused by the entrance into the system of a specific microörganism (the micrococcus framboesia), which has a predilection for the cutaneous system, producing by its presence there an irritation and a growth of the deeper layers. Although pyrexia is a marked feature of all the exanthemata and although framboesia is ushered in without febrile symptoms of any consequence, still there is no doubt that there is some rise of temperature in most cases, even though that be slight. It must not be forgotten that these cases occur, not in hospital practice where patients can be carefully watched, but among an ignorant and untrained class of negro laborers.

Taking all the symptoms of yaws into consideration I have been led to the conclusion, aided by a not inconsiderable experience of the disease in Dominica,

[1] Third edit., 1873.
[2] Vol. 11, p. 515.
[3] 1885, Second edit., p. 16.
[4] Diagnosis of Skin Diseases, 1878, p. 27.
[5] Dr H. Radcliffe Crocker's Skin Diseases, 1888.

Plate XIX

Montserrat, and Antigua, that framboesia belongs properly to the class of exanthemata, and should be placed under heading A of the table quoted from the Nomenclature of Diseases.[1]

FRAMBŒSIA IN THE FOWL.

Before concluding this report upon framboesia as it occurs in man, I have thought that a few words upon the disease as it occurs in the domestic fowl may not be unacceptable. The disease occurs as an epidemic among fowls in Ceylon and the West Indies, and probably in the other tropical countries as well, at certain seasons of the year,[2] generally from April to July or August. It bears a striking resemblance to the disease met with in the human subject in many particulars, but whether there is a causal relation or connection between the two diseases I am not in a position to state.

The disease in question consists of an eruption of yaws-like tubercles covered by a thin seal (resembling in appearance the yaws crust), very often showing points of hæmorrhage on its surface, just as in the case of the human subject. These tubercles are situated over the eyes, at the base of the beak, on the head and neck, around the ears, on the tips of and along the wings wherever there are few feathers, and on the legs. Young fowls and turkey chicks are chiefly affected, and death may occur, not from the disease itself, but from the inability of the birds to see and pick their food and their consequent starvation.

Plate XIX is a photograph of the head of a chicken with yaws. The eyelid is occupied by a tubercle; there is one over the ear and two or three immediately over the bill.

The points of resemblance to human yaws are the following, and I do not think I shall be going too far when I say that they are more than mere coincidences: (1) The tubercles bear a striking resemblance outwardly to those of the human subject. (2) The disease occurs on the most unprotected parts in both. (3) Young chickens are chiefly affected. I do not remember having seen the disease in full-grown fowls. In the human subject children are the principal sufferers. (4) There is similarity in the site of the eruption in the fowl to that in man. (5) A micrococcus, such as I have discovered in human yaws tubercles, is also seen scattered throughout those of the fowl. (6) A yaws tubercle from the lid of a fowl was excised, and a sterile tube of nutrient jelly was inoculated immediately with the blood that issued from the cut. In three days a grayish-colored cloudiness was seen in the track of the stab and the jelly was rendered slightly fluid on the surface. The turbidity was due to the presence of myriads of coccus forms, singly, in two's, and in small clusters. Their size was the same as the microbe of human yaws. About a week afterwards the growth assumed a pinkish tinge and

[1] It is worthy of remark that in the parangi disease of Ceylon, which is considered to be identical with yaws, a rise of temperature has been noted to precede an outbreak of the eruption. I quote from page 75 of the Report upon the Parangi Disease of Ceylon, by Mr. W. Kynsey, principal civil medical officer: "Fever occurs; in some instances it is very severe in character (the temperature being 99°, and sometimes rising as high as 100° or 102° in the evening); it is comparatively slight in others. The fever is attended with constitutional disturbance; it remains for about two or three days, when a crop of eruptions, papular in character, appear about the different parts of the body beginning at the face and gradually extending downwards; these papules vary in size from that of a peppercorn upward." Again, on page 46, Mr Garvin says: "Just as the sore was healing [the sore Mr. Garvin mentions was the seat of inoculation of the parangi disease] he got what he considers an attack of fever, attended with pain in the large joints and back. This attack went on for about four days and then subsided, but on the third day following he observed the eruption coming out on the right side of the neck first and then over the body." The same medical officer observes, on page 45 of the report: "A crop of eruption appeared on the face, preceded by slight fever, loss of appetite, malaise, and pains in the large joints for a day or two." *Vide*, also in Appendix, Case CXXVIII, where a febrile condition is reported as having occurred previous to the appearance of the eruption.

[2] The negroes say when the cashew fruit (Anacardium occidentale) is ripe.

the jelly became more diffluent. These appearances then are identical with those presented by the microbe of human yaws. (7) Lastly, a vertical section of a framboesia tubercle in the fowl presents the same anatomical appearances as those already described in the case of man; that is to say, enlargement and growth of papillæ, proliferation of cells, and protrusion of new vascular growth upward through the epidermis.

Plate XX a vertical section of a yaws tubercle from the fowl. Logwood staining. Leitz, Oc. 2, Obj. 3: (α) Enlarged papillæ: (β) delicate strands of fibrous tissue; (γ) blood vessels (cut); (δ) protrusion of organized tissue externally; (ε) areolar tissue. (The proliferation of cells well marked, but their outlines are somewhat overtinted in the diagram.)

The disorder is easily cured by isolation of the affected birds and their careful feeding, together with the external application to the tubercles of tincture of iodine.

I may say that an attempt at producing the disease in a chicken by inoculating it under the wing with the artificial culture of the micrococcus from a diseased bird proved ineffectual.

Plate XX

APPENDIX.

List of cases of framboesia.

No.	Name.	Age.	Nationality.	Residence.	First treated.	When cured.	Remarks.
		Years.					
I	Dublin Dublin	47	Negro	St. Philips	Mar. 14, 1882	End of October, 1882.	
II	Alf. Tomlinson	12	Mulatto	do	Mar. 24, 1882	May, 1882	Ointment alone used.
III	Amelia Simpson	[1]22	Negro	do	Aug. 28, 1882	First week of December, 1882.	Do.
IV	Judy Mason	7	do	do	Oct. 2, 1882	Dec. 15, 1882	
V	Wilkinson Hughes	23	do	do	Oct. 9, 1882	Nov. 18, 1882	
VI	Virginia John	40	do	do	do	Jan. 5, 1883	
VII	Nathaniel George	3	do	do	Oct. 20, 1882	Jan. 12, 1883	
VIII	Mary Lewis	2¾	do	do	Nov. 8, 1882	Apr. 6, 1883	
IX	Bobby Thwaites	6	do	do	Nov. 10, 1882	Dec. 29, 1882	Relapse on April 30, 1883; cured again middle of May, 1883.
X	Maria Moses	8	do	do	Nov. 17, 1882	May 30, 1883	
XI	Eliza Lewis	7	Mulatto	do	May 24, 1882	Mar. 30, 1883	
XII	Abraham Joseph	6	Negro	do	Jan. 19, 1883	May 29, 1883	
XIII	Charles Thomas	4½	do	do	Jan. 7, 1883	Feb. 14, 1883	
XIV	Edward Byam	5	do	do	Jan. 26, 1883	Apr. 15, 1883	
XV	Joseph Martin	4	do	do	do	Apr. 29, 1883	
XVI	Anne Peters	2	do	do	do	July 31, 1883	
XVII	Ellen Joseph	6	do	do	Mar. 18, 1883	June 16, 1883	
XVIII	Lydia George	[1]10	do	do	Mar. 19, 1883	Aug. 14, 1883	Sister of No. 7. Infection probably from No. 7.
XIX	Catherine Charles	1	do	do	Mar. 26, 1883	July 7, 1883	
XX	Margaret Kirby	2	do	do	Mar. 5, 1883	May 30, 1883	
XXI	Anne Baptiste	4	do	do	Apr. 11, 1883	July 31, 1883	
XXII	Maria Thomas	44	do	do	Apr. 13, 1883	May 30, 1883	
XXIII	Josiah Farrants	6	Mulatto	do	do	June 7, 1883	
XXIV	Cecilia Roberts	3	Negro	do	do	May 28, 1883	
XXV	Robert Wyre	7	do	do	May 21, 1883	July 31, 1883	
XXVI	Wm. Harris	3	do	do	July 15, 1883	Sept. 16, 1883	
XXVII	Baby Williams	2	do	do	Aug. 13, 1883	Mar. 13, 1884	
XXVIII	Anne Green	12	Mulatto	do	June 18, 1883	Oct. 30, 1883	
XXIX	John Joseph	30	Negro	do	July 9, 1883	Oct. 28, 1883	
XXX	Rosetta Kirby	1	do	do	Sept. 30, 1883	Dec. 29, 1883	Sister of No. 20.
XXXI	Anne Righton	6	do	do	Oct. 8, 1883	Jan. 6, 1884	Relapse end of June, 1884; cured end of September, 1884.
XXXII	Maria Joseph	[1]14	do	do	Nov. 21, 1883	Jan. 31, 1884	
XXXIII	Joseph Mathew	4½	do	do	Dec. 27, 1883	Apr. 30, 1884	
XXXIV	Jacob Brown	4	do	do	Jan. 12, 1884	May 20, 1884	
XXXV	James Constant	6	do	do	Jan. 14, 1884	May 30, 1884	
XXXVI	John Ward	7	do	do	Mar. 2, 1884	June 27, 1884	
XXXVII	Thomas Blackwell	9	do	do	Mar. 17, 1884	July 31, 1884	
XXXVIII	George Michael	4½	do	do	July 27, 1884	Oct. 30, 1884	

[1] Months.

List of cases of frambœsia—Continued.

No.	Name.	Age.	Nationality.	Residence.	First treated.	When cured.	Remarks.
		Years.					
XXXIX	Edward Cornelius	8	Negro	St. Philips	Aug. 3, 1884	Dec. 20, 1884	
XL	Walter Parker	5	Mulatto	do	Aug. 19, 1884	Nov. 30, 1884	
XLI	Margaret Henry	5	do	do	Sept. 24, 1884	Dec. 7, 1884	
XLII	Rhodia Patrick	[1] 6	Negro	do	Oct. 20, 1884	Dec. 31, 1884	
XLIII	Benjamin Thomas	5	do	do	Nov. 10, 1884	do	
XLIV	James Joseph	3	do	do	Nov. 17, 1884	Apr. 27, 1885	
XLV	Mary Righton	3¼	do	do	Nov. 18, 1884	Apr. 30, 1885	Sister of No. 31.
XLVI	Marianne Gilead	4	do	do	Dec. 29, 1884	July 31, 1885	
XLVII	Azariah Lynch	16	do	do	Jan. 21, 1885	Oct. 28, 1885	Was treated for crab yaws; had had it since June, 1884.
XLVIII	Louisa Thomas	1	do	do	June 13, 1885	Aug. 15, 1885	
XLIX	Margaret Henry	35	do	do	do	Sept. 7, 1885	Mother of No. 48.
L	Mathew Roberts	6	do	do	Sept. 2, 1885	Oct. 31, 1885	
LI	Christiana Green	11	Mulatto	do	Sept. 21, 1885	Feb. 20, 1886	Sister of No. 28. Was treated for crab yaws; had eruption on body in August.
LII	Louisa Grayman	8	Negro	do	Sept. 22, 1885	Jan. 9, 1886	
LIII	Charlotte Green	14	Mulatto	do	do	Oct. 25, 1885	Sister of Nos. 28 and 51.
LIV	Mrs. Gilead	35	Negro	do	Sept. 24, 1885	Nov. 17, 1885	Mother of No. 46.
LV	Edgar George	[1] 10	do	do	Oct. 4, 1885	Dec. 21, 1885	
LVI	Rob. Hughes	17	do	do	Oct. 11, 1885	Dec. 31, 1885	
LVII	Edward Gilead	45	Mulatto	do	Oct. 12, 1885	Dec. 30, 1885	Husband of 54. Probable contagion from No. 54.
LVIII	Eleonora Thomas	3	Negro	do	Oct. 18, 1885	Dec. 7, 1885	
LIX	Susanna Thomas	4	do	do	do	Jan. 9, 1886	Sister of No. 58.
LX	Rebecca Jeremy	10	do	do	Oct. 21, 1885	Jan. 10, 1886	
LXI	Marianne Dickerson	5	do	do	Nov. 17, 1885	Jan. 9, 1886	
LXII	Lauchlan Joseph	5	do	do	Dec. 7, 1885	Feb. 27, 1886	
LXIII	Thomas Kirby	1	do	do	do	Jan. 31, 1886	Brother of No. 20.
LXIV	Louisa Thomas	6	do	do	Dec. 12, 1885	Mar. 31, 1886	
LXV	Caroline Lewis	3	do	do	Dec. 15, 1885	Mar. 16, 1886	
LXVI	Sam. Lawrence	1	do	do	Dec. 16, 1885	Mar. 31, 1886	Relapse middle of August, 1886; well again end of February, 1887.
LXVII	Mary Adams	45	do	do	Jan 3, 1886	Feb. 27, 1886	Mother of No. 55.
LXVIII	Joseph Thomas	8	do	do	Jan. 25, 1886	End of March, 1886.	
LXIX	Daniel Cornelius	1½	do	do	Jan. 26, 1886	Mar. 31, 1886	
LXX	Charles Cornelius	[1] 20	do	do	Feb. 13, 1886	do	
LXXI	Frances Joseph	14	do	St. Peters	Oct. 16, 1886	Dec. 30, 1886	
LXXII	Archibald Philo	5	do	do	Aug. 10, 1886	Aug. 28, 1886	Cure very rapid in this case.
LXXIII	Beatrice Philo	6	do	do	Sept. 5, 1886	End of October, 1886.	Sister of No. 72.
LXXIV	Charlotte Philip	7	do	St. Philips	do	Nov. 15, 1886	
LXXV	Jerusha Samuel	4	do	do	Sept. 27, 1886	Nov. 30, 1886	
LXXVI	John Lawrence	5	do	do	Nov. 7, 1886	Jan. 15, 1887	Brother of No. 66. Probable contagion from him.
LXXVII	Charlotte Yankee	1½	do	do	do	Jan. 31, 1887	
LXXVIII	Frederick Benjamin	1	do	do	Jan 13, 1887	Mar. 15, 1887	
LXXIX	Charlotte Lawrence	30	do	do	Feb 28, 1887	Apr. 15, 1887	Mother of No. 66. Probable case of contagion from No. 66.
LXXX	Mary Joseph	[1] 19	do	do	Apr. 8, 1887	June 30, 1887	

LXXXI	Albert Joseph	11	Negro	St. Phillip	June 19, 1887	July 31, 1887	Brother of No. 80. Probable case of contagion.
LXXXII	Jane Lynch	7	do	do	Aug. 14, 1887	Oct. 15, 1887	
LXXXIII	Augusta Lynch	5	do	do	Aug. 20, 1887	Oct. 31, 1887	Nos. 82 and 83 are sisters of No. 47. 82 and 83 probable cases of contagion.
LXXXIV	James Smith	9	do	St. Pauls	Aug. 21, 1887	Dec. 3, 1887	
LXXXV	Montague Pearson	2	do	St. Philips	Aug. 23, 1887	Nov. 17, 1887	
LXXXVI	Anne Pearson	4	do	do	Aug. 25, 1887	Dec. 30, 1887	Sister of No. 85. Nos. 66 and 76 are cousins, and No. 79 aunt of 85 and 86. All constantly together.
LXXXVII	Wm. Thomas	2	do	St. Peters	Aug. 26, 1887	End of November, 1887.	
LXXXVIII	John Francis	4½	do	do	Aug. 28, 1887	Dec. 30, 1887	
LXXXIX	Lucretia Mark	12	do	St. Philips	Sept. 12, 1887	Feb. 15, 1888	
XC	Charles Spencer	18	do	St. Pauls	Sept. 13, 1887	Feb. 20, 1888	
XCI	John Braithwaite	2	do	do	do	Feb. 10, 1888	
XCII	Philip Isaac	6	do	St. Philips	Oct. 4, 1887	Jan. 3, 1888	
XCIII	Wm. Yankee	22	do	do	Oct. 6, 1887	Dec. 26, 1887	
XCIV	Amelia Adams	4	do	do	Dec. 4, 1887	Feb. 8, 1888	
XCV	Arthur Nicholas	7	do	do	Dec. 5, 1887	In 6 weeks	
XCVI	Charles Thomas	6	do	do	Dec. 19, 1887	May 4, 1888	
XCVII	James Richards	3	do	St. Pauls	Feb. 29, 1888	July 6, 1888	Treated for crab yaws. Had had ordinary eruption on body a year ago.
XCVIII	George Henry	9	do	do	Mar. 7, 1888	May 9, 1889	Consulted me for yaws ulcers.
XCIX	Alfred Spencer	2½	do	do	do	July 6, 1888	Brother of Nos. 90 and 100. All probable cases of contagion.
C	James Spencer	14	do	do	Mar. 9, 1888	Aug. 2, 1888	
CI	Henrietta Joseph	4	do	St. Philips	May 20, 1888	July 17, 1888	
CII	James Hughes	1½	do	do	Aug. 19, 1888	Dec. 6, 1888	
CIII	Josephine Francis	2½	do	do	Oct. 14, 1888	Feb. 13, 1889	
CIV	Alice Frederick	4	do	St. Pauls	Dec. 27, 1888	Mar. 9, 1889	
CV	Joseph Cochrane	5	do	St. Philips	Dec. 28, 1888	Mar. 17, 1889	
CVI	Catherine Richards	16	do	St. Pauls	Jan. 17, 1889	April 30, 1889	Sister of No. 97.
CVII	Rebecca Wood	17	do	St. Philips	Feb. 5, 1889	May 19, 1889	
CVIII	Arthur Warner	12	do	St. Pauls	Feb. 6, 1889	May 30, 1889	
CIX	Lucy Rodish	10	White. Portuguese.	do	do	April 27, 1889	
CX	Louisa Henry	50	Negro	St. Philips	do	May 31, 1889	
CXI	Henry Josiah	10	do	do	Feb. 7, 1889	May 13, 1889	Lived with No. 110. Had had yaws since September, 1888.
CXII	Charles Moore	7	do	do	do	April 17, 1889	Had had yaws since November, 1888.
CXIII	Henrietta Richards	12	do	St. Pauls	Feb 9, 1889	May 3, 1889	Sister of Nos. 97 and 106; probable cases of contagion
CXIV	Charles Green	10	Mulatto	St. Philips	Mar. 31, 1889	May 11, 1889	Brother of Nos. 51 and 53.
CXV	Caroline Rodish	15	White, Portuguese.	St. Pauls	May 1, 1889	May 31, 1889	Sister of No. 109. Had had yaws since middle of April, 1889. Probable case of contagion.
CXVI	Eliza Bailey	8	Mulatto	do	May 15, 1889	In 5 weeks	Probable contagion from Nos 109 and 115.
CXVII	John Comacho	10	White, Portuguese.	St. Philips	Jan. 4, 1890	In 3 weeks	Said to have got the disease from a negro child, his playmate, who had yaws.
CXVIII	Sarah Richards	3	Negro	St. Pauls	Feb. 5, 1890	End of April, 1890.	Sister of Nos. 97, 106, and 113. Probable cases of contagion.
CXIX	Felicia Charles	11	do	do	do	do	Had had yaws since November, 1889.
CXX	John Francis	6	do	St. Philips	June 1, 1890	End of July, 1890.	Brother of No. 103.
CXXI	Sam. Lewis	6	do	St. Pauls	June 18, 1890	July 15, 1890	Had had yaws since May, 1890.

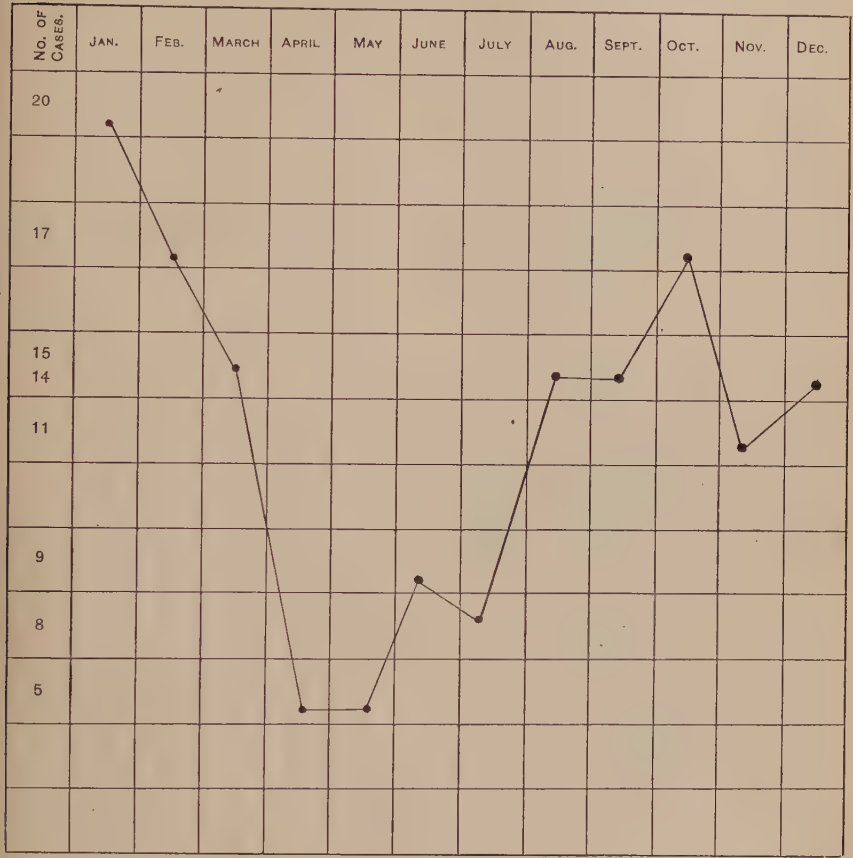
[1] Months.

List of cases of framboesia—Continued.

No.	Name.	Age.	Nationality.	Residence.	First treated.	When cured.	Remarks.
		Years.					
CXXII	Dulcinia Joseph	18	Negro	St. Philips	June 23, 1890	July 31, 1890	Sister of No. 101. Had had yaws since previous May.
CXXIII	Mrs. Joseph	40	do	do	do	Aug. 15, 1890	Had had yaws since last week of previous May. Mother of Nos. 101 and 122. Probable contagion.
CXXIV	Ruth Peter	4	do	St. Pauls	July 21, 1890	Sept. 30, 1890	Had had yaws since previous June.
CXXV	Henrietta Jackson	1½	do	do	July 31, 1890	Aug. 30, 1890	Had had yaws for 2 weeks previously.
CXXVI	Henry Jas. Stephen	31	do	do	Oct. 2, 1890	Nov. 14, 1890	Was ill for 10 weeks previous to seeing me.
CXXVII	Attrill Isaacs	6	do	St. Philips	Nov. 29, 1890	Dec. 31, 1890	
CXXVIII	Wm. Benjamin	2	do	St. Pauls	Dec. 3, 1890	do	Relapse January 3, 1891, ushered in by high fever. Got well in February, 1893.
CXXIX	Thomas Peter	7	do	do	Dec. 21, 1890	Jan. 4, 1891	Brother of No. 124, who was the probable source of infection.
CXXX	Frances Osborne	2¼	do	St. Philips	Jan. 4, 1891	Mar. 31, 1891	
CXXXI	Mary Hector	7	do	St. Pauls	Jan. 14, 1891	April 27, 1891	Had had yaws 3 months ago. Mother (Cecilia Warner) thinks No. 131 got the disease from her brother, No. 108, who was staying in the same house as No. 131.
CXXXII	Jas. Bowers	2	do	do	Jan. 17, 1891	April 30, 1891	Brother of 133 and 134.
CXXXIII	Wm. Bowers	8	do	do	do	June 7, 1891	Had had yaws since latter end of 1890.
CXXXIV	Frances Bowers	6	do	do	do	Aug. 15, 1891	Had yaws 2 years ago. When seen had tubercle on palmar surface of right forefinger. 133 and 134 sleep together.
CXXXV	Beatrice Frederick	5	do	St. Philips	Feb. 16, 1891	June 19, 1891	
CXXXVI	Victor Harley	8	do	St. Pauls	do	May 26, 1891	Had had yaws since the month previous.
CXXXVII	Theoph. James	5	do	do	July 5, 1891	Oct. 31, 1891	Had had yaws since last year, the mother states.
CXXXVIII	Joseph Harvey	6	do	St. Philips	July 9, 1891	End of September, 1891.	
CXXXIX	John Jacob	3	do	do	July 26, 1891	End of October, 1891.	
CXL	Florence Lewis	5	do	do	Aug. 16, 1891	do	Belongs to St. Pauls; came from that parish to St. Philips with yaws.
CXLI	Henry Burton	5	do	do	Aug. 31, 1891	Nov. 30, 1891	Playmate of No. 139, from whom disease was probably contracted.
CXLII	Mary Appleton	16	do	St. Peters	Sept. 3, 1891	Jan. 30, 1892	A lad, Adolphus Henry, with yaws, was living in same house as 142.
CXLIII	Geo. Smith	2	do	St. Philips	Sept. 7, 1891	Dec. 20, 1891	
CXLIV	Gustavus Hector	[1] 14	do	do	Jan. 25, 1892	Mar. 27, 1892	Had had yaws since beginning of December, 1891.
CXLV	Christopher Smith	12	do	St. Pauls	Mar. 25, 1892	End of July, 1892.	Had had yaws since beginning of February, 1892.
CXLVI	Alfred Smith	7	do	do	do	Sept. 23, 1892	Brother of No. 145. Both sleep together. Disease contracted probably from No. 145.
CXLVII	Joseph Lake	6	Mulatto	St. Philips	do	May 28, 1892	
CXLVIII	Elsinia Martin	4	Negro	do	Feb. 3, 1893	Apr. 26, 1893	Ill since first week of January, 1893.
CXLIX	Arthur Martin	6	do	do	do	June 19, 1893	Nos. 148 and 149 are not neighbors.
CL	Herbert Brookes	1½	do	do	Feb. 20, 1893	July 4, 1893	Ill since beginning of January, 1893.
CLI	Elkana Michael	9	do	St. Pauls	June 17, 1893	Still ill (July 12, 1893).	Ill since the previous April. Brother of No. 123, who was the probable source of infection.

[1] Months.

The following table shows the frequency of the disease in the various months of the year from March, 1882, to June, 1893:



SECTION XVI.—DISEASES OF THE MIND AND NERVOUS SYSTEM.

Honorary Presidents.

Dr. Jorge Diaz Albertina, Havana, Cuba.
Dr. Juan C. Castillo, Lima, Peru.
Dr. C. G. Comegys, Cincinnati, Ohio.
Dr. F. X. Dercum, Philadelphia, Pa.
Dr. J. T. Eskbridge, Denver, Colo.
Dr. Orpheus Everts, College Hill, Ohio.
Dr. Juan N. Govantes, City of Mexico, Mexico.
Dr. Allen McLane Hamilton, New York, N. Y.
Dr. Wm. A. Hammond, Washington, D. C.
Dr. P. O. Hooper, Little Rock, Ark.
Dr. Henry M. Hurd, Baltimore, Md.
Dr. J. G. Kiernan, Chicago, Ill.
Dr. J. A. McBride, Wauwatosa, Wis.
Dr. Chas. K. Mills, Philadelphia, Pa.
Dr. S. Weir Mitchell, Philadelphia, Pa.
Dr. Moncorvo, Rio de Janeiro, United States of Brazil.
Dr. Putnam, Boston, Mass.
Dr. E. C. Seguin, New York, N. Y.
Dr. E. C. Spitzka, New York, N. Y.
Dr. G. Isaac Ugarte, Santiago, Chile.
Dr. Sam'l Webber, Boston, Mass.
Dr. Joseph Workman, Toronto, Canada.

Executive President.

Dr. C. H. Hughes, 500 North Jefferson street, St. Louis, Mo.

Secretaries.

A. B. Richardson (English-speaking), Columbus, Ohio.
Dr. Meléndezy Cabreá (Hospicio San Buenaventura), Buenos Ayres, Argentine Republic.
Dr. Nicolas Hortiz, La Paz, Bolivia.
Dr. Cárlos Eiras, Rio de Janeiro, United States of Brazil.
Dr. Stephen Lett, Guelph, Canada.
Dr. Plaido, Kingston, Jamaica, West Indies.
Dr. Pablo García Medina (carrera 8, núm. 277), Bogota, Republic of Colombia.
Dr. Pellais, Leon, Nicaragua.
Dr. M. G. Echeverria, (Spanish-speaking), Key West, Fla.
Dr. Emiliano Nuñez (Galiano 19), Havana, Cuba.
Dr. José Azurdia, Guatemala City, Guatemala.
Dr. George Herbert, Wailuku Maui, Hawaii.
Dr. Secundino E. Sosa (Hospital de Mujeres Dementes), City of Mexico, Mexico.
Dr. Francisco Soca (Florida 90), Montevideo, Uruguay.
Dr. Hemiterio Formez, Merida, Venezuela.

ADDRESS OF THE PRESIDENT OF THE SECTION, C. H. HUGHES, M. D., ST. LOUIS, MO.

NEUROLOGY AND PSYCHIATRY OF THE FIRST PAN-AMERICAN MEDICAL CONGRESS.

COLLEAGUES OF THE CONTINENT: I bid you cordial welcome. For the first time in the history of the world the medical profession of all the Americas meets fraternally for mutual work and words of counsel for the welfare of the North and South American medical profession and people. In this neurologic and psychiatric section, brothers, we also, for the first time, grasp the hand of fellowship. We heartily clasp hands with you and in our hearts we embrace you, with the prayer that nothing shall ever dissever the friendship between the Northern and Southern American profession now so auspiciously consummated. May the final hand shake between the profession of the North and South American States never be permitted to take place. We want your friendship forever. So long as "earth grows a plant or sea rolls a wave" we pray that it may endure, growing closer and closer in ties of inseparable fraternity. In our special departments of medical research and labor we have a common interest, and in every department of medical investigation and advance our interests are likewise mutual. The sanitary welfare of all of the American States is alike. The same hygienic, therapeutic and pathologic problems press upon us all for solution; the medical discoveries of each one of these States redound to the welfare of all the others. To this end, therefore, we salute and welcome you, wishing you health and happiness, through a mutually advanced and glorified medical profession, and in behalf of the neurological section of this great congress I join you in the sentiment, "*America laudamus—viva Americana!*"

Before proceeding to the work before us it may prove a source of pleasure and profit, and it certainly is flattering to our professional pride, to note some of the neurological advances of our day, and especially the contributions of neurology to general medicine and the consequent welfare of the world. None of the many victories in the onward march of American medicine during the century now nearing its close has contributed, or is destined yet to contribute, more to the happiness of mankind than the light which has been thrown by our researches on the nature and treatment of inebriety, dipsomania, and chronic alcoholism and their neural sequelæ, especially multiple neuritis.

To a distinguished American physician, signer of that Declaration which gave a nation birth, surgeon-general of the Continental Army and teacher of the practice of medicine in the first medical university founded in America, Dr. Benjamin Rush, the scientific world is indebted for having taught that inebriety is a disease. His followers, living in the Pan-American States, taking their cue from this distinguished pioneer medical *savant*, have pursued the study until the therapeutics of inebriety has become as successful as that of any other grave nervous disorder and its pathology as well understood, while medical philanthropy, following his advice,[1] has erected hospitals for the cure and care of its unfortunate victims, though, as yet, no monumental shaft mementoes, as it should, a nation's grateful memory of Benjamin Rush's noble work.

We record, also, with satisfaction scarcely exceeded by that we enjoy from contemplating the salvation of the inebriate the successful cure of the opium habit and other kindred forms of baneful drug enslavement. Yet it has not been long since that once brilliant litterateur, De Quincey, himself enthralled, proclaimed in despair the "pangs of opium" and the "Iliad of woes" its enslaved victims hopelessly endured. The "opium fiend," as he is with cruel facetiousness so often called, need not be longer regarded as a hopeless wreck if the hand of charity will

[1] Diseases of the Mind, 1812.

only conduct him within the pale of professional resource. This and alcoholism, and all similar forms of nervous derangement, are now treated successfully much like certain forms of mental aberration are; by change of environment, by therapeutic repression, including hypnotic support and reconstruction of the damaged and aberrantly acting neuropsychic centers. This is another jewel medicine offers for the crown of modern progress.

Notwithstanding the illustrious names which in our own day the world beyond our geographical boundaries has given to medical science, our American States have likewise their great physicians whose offerings on the altar of that science whose special care is the welfare of man are worthy of exalted place beside the Old World's gods. For the Virchows, Charcots, and Lombrosos, Maraglianos and Kowalewskys, Gulls and Horsleys, of world-wide fame beyond our shores, we have given to the world our Brown-Séquard, who went from America to cosmopolitan fame; our Hammond, another pioneer American neurologist, whose books have been translated into all the languages of civilization: our Seguin likewise, and our Pepper, president of this congress and the peer of Sir William Gull, of Great Britain; and Ferran, whose preventive inoculations against cholera Asiatica called the medical world's attention anew to the grandeur of Spanish medicine. If Wigan could conjecture the duality of the mind from theoretical considerations and the general division of the brain into hemispheres, Brown-Séquard later, and at the time an American, proved it, and even my own feeble contribution on the "Duality of Action and Vicarious Functions of the Cerebral Lobes and Hemispheres,"[1] in 1873, might count for something, even though it emanated from a lunatic asylum in the valley of the Mississippi. If Hitzig, a German, and Ferrier, an Englishman, demonstrated and located motor centers in the cerebrums of the lower animals, Bartholow, an American, established by satisfactory physiological experiment their correspondence in the human brain.[2] If Victor Horsley and others first clinically applied the discovery of cerebral localization to surgical therapeutics for brain diseases, Prof. William Fuller, a Canadian anatomist and surgeon, first trephined the skull in a case of idiocy, an operation which has recently been heralded from abroad as a new surgical procedure. The author of this operation, now residing in this country, in Grand Rapids, Mich., is the designer from life of a series of brain sections and sectional casts, photographs, and models, some of which I now show you, which have not been excelled in Europe. Now that this operation of Dr. Fuller has come back to America with European approval as a European procedure, it is interesting to note the reception a part at least of the medical press of England gave the novel surgical procedure at its inception on this continent. The following extract from the London Doctor, a monthly review of British and foreign medical practice and literature, No. 1, Vol. IX, page 5, January 1, 1878, is appended as evidence that the case reported in this paper received at the time a wide publication:

Dr. Fuller, of Montreal, has, says the Canada Lancet, conceived the novel idea of trephining out portions of the skull of an idiot child of 2 years old, so as to allow the expansion of the brain. The idea is certainly novel, so far as we know, no surgeon having previously ventured to remove portions of the skull cap so as to allow the brain to expand. We sincerely hope this brilliant (!) experiment will not be repeated. How does Dr. Fuller propose to protect the exposed portions of brain should the brain protrude through the apertures he has made? According to latest advices Dr. Fuller contemplates removing another piece. We hope not.

Under the name of linear craniotomy, this operation has recently found decided approval both at home and abroad. Engel speaks enthusiastically of it even for dementia epileptica.

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[1] American Journal of Insanity, Vol. XXXII, 1875.

[2] American Journal of the Medical Sciences.

If European surgery first exsects a stomach or a kidney, or cuts down upon and removes a stone from the bladder or gall cyst, American surgery, represented in the person of Ephraim McDowell, with a temerity that startles the conservatism of Europe, first cuts into that surgical *terra incognita*, the abdominal cavity and saves an imperiled human life by successfully removing an abdominal tumor, a feat common enough now, alas, all too frequently performed by novices lacking in mature surgical judgment. He and Battey, another American, led the way for the successful ovariotomies of Lawson Tait and his followers, and Marion Sims—God bless his gentle, precious memory—lays the foundation, by a peerless procedure on the female perineum, for the rescue of womanhood from untold misery. Marion Sims who, when asked to unsex a woman in whom there was other possibility of salvation, could say to Weir Mitchell, "Let us give her a reprieve; I never unsex a woman without a pang," and the woman got well, as you and I know hundreds of others would, if permitted, without oöphorectomy. God bless Marion Sims.

As we are justly appreciative of the part which American skill has performed in the world's surgical advancement; as the recalling of the names and deeds of our Motts, Brainards, Popes and Stones, Physics, Grosses and Hodgens gives us pleasure; if we revere our Rushes and Woods as England does her Hunters, Sydenhams, and Gulls, so of our own American alienists and neurologists and their achievements, we are justly proud. The accomplished Isaac Ray and the gifted Amariah Brigham, Pliny Earle and Tyler, now no longer among us, and Van Dusen, the son of Michigan and a Kalamazoo asylum superintendent, whose essay on "Neurasthenia" preceded that of the classical work of Beard on Nervous Exhaustion—Beard who gave to the world a new disease, and gave it a new name, although the term "neurasthenia" was borrowed unknowingly from Van Dusen (*vide* Alienist and Neurologist, Vol. I., No. 4, 1880). Since these contributions appeared the subject of nervous exhaustion has become too common in the literature of this country and Europe to need further mention here.

There are three works of Dr. Hammond which have had much influence on neurology and medicine generally and these were accomplished during his service as surgeon-general on the active list of the U. S. Army. (1) The establishment of the Hospital for Injuries and Diseases of the Nervous System in Philadelphia, where the foundation of Dr. Weir Mitchell's most original work, "Wounds and Injuries of Nerves," was laid, Dr. Mitchell having been placed in charge by Surgeon-General Hammond. (2) The establishment of the Army Medical Museum in Washington. (3) The origination of the Medical and Surgical History of the War of the Rebellion. These three things give our colleague just claim to distinction. I think the Hospital for Nervous Diseases was the first of its kind ever established in the world. Besides, our colleague wrote the first systematic Treatise on Diseases of the Nervous System in the English language, if not in any language.

If we look for new discovery and classification of disease, America has not been entirely wanting. For a long time Beard's claim was controverted abroad, afterwards neurasthenia was called "the American disease," then "American nervousness," till finally foreign writers recorded it among their people, even in far-off Russia, where Kowalewsky has written his classic book on the subject and given us due credit for our discovery. So in regard to Hammond's discovery of athetosis and mysophobia, and the coinage of these terms; and in regard to neurasthenia, I believe it is even now conceded that the original American claim[1] of general functional neurotrophia as the foundation of nervous exhaustion is universally admitted.

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[1] *Vide* Alienist and Neurologist, Vol. III, No. 3, 1882.

Seguin, in his clinical lectures in 1890, first suggested the substitution of a mixture of chloral and bromide for simple bromide, in the treatment of idiopathic epilepsy, when certain indications are present, chloral being indicated when the bromides alone produce undue stupor and extremely severe acne; also in cases where psychic disorder follows the stoppage of the bromides. This practice has now become general. He first attempted to subdivide the symptomology of "cerebral hyperæmia" (of Hammond and others) into several new groups according to etiology, e. g., cases due to lithæmia, to feeble or diseased heart, and (a large group) to eye strain, etc. He also attempted to give the distinguishing clinical signs (New York Medical Journal, December, 1892) between cases of cerebral paræsthesia due to insufficiency of the interni and those due to insufficiency of the externi, and recommended the use of nux vomica and strychnine for weakness of the interni, and of belladonna, cannabis indica, and other mydriatics for weakness of the externi, these drugs to be used as tests for diagnosis, and also for continuous treatment. He contributed by autopsies and clinical cases to confirm the doctrine of cortical localization of functions, in respect to the visual center (cuneus in 1880, I think), the speech center (1868), and, in subsequent years, the facial, brachial, and pedal or crural, centers, and gave absolute post-mortem evidence in support of the idea that such centers exist. Besides Bartholow's communication the whole subject of cerebral localization has received additional light from the contributions of our Charles K. Mills, of M. Allen Starr, Eskridge, Spitzka, myself, and nearly every American neurologist, while the contributions of Spitzka to cerebral pathology, as those of Isaac Ott to cerebral physiology, have been justly acknowledged abroad. Seguin and Hammond early advocated, before anyone abroad, I think, the use of large doses of potassium iodide in syphilitic or non-syphilitic diseases of the nervous system, giving historical proof of its American origin (New York), and called it the "American method." Attempts have been lately made in Europe to ignore our great priority in this. S. and H. Seguin say they learned it from Van Buren and Draper in 1865–1867. I adopted this practice at the insane hospital at Fulton in 1867–1868.

It falls to the lot of but very few men to discover a really important thing and to cause a great forward step to be made in medical science. Most of us must be content with helping the good work of adding new facts of secondary importance, and trying to apply scientific methods to the treatment of disease. I think that in this sphere of secondary scientific usefulness American neurologists have made and are making good records. The clinical relation of absent patellar reflex to locomotor ataxia, though first shown by Westphal and Erb, was extensively studied by Seguin, Gray, myself, and others, and its relation to other diseases and the possibility of the knee jerk being naturally *nil* in some persons, was first shown in this country and acknowledged abroad,[1] so that the knee-jerk criteria of tabes dorsalis is a lost reflex, and lateral sclerosis and other states of an exaggerated reflex I myself offered the first proof many years ago that it need not be present in apparently healthy individuals. One of those persons still lives and is free from any spinal or other nervous disease to this day. What is true as to elucidation of this reflex is equally true of the cremasteric and other reflexes. (*Vide* writings of Weir Mitchell and others.) The bulbo-cavernous reflex and the virile reflex, practically the same thing, were discovered and clinically elucidated about the same time in Europe and America.

The value of the cremasteric reflex has been studied by Weir Mitchell with the same thoroughness of elucidation as he has given to lesions of the peripheral nervous system generally; and Dr. John Ferguson, of Toronto, Canada, has also thrown new light upon the patellar reflex. (*Vide* "Remarks on some cases of Hemi-

[1] "Diagnostic Significance of Absent Patellar Reflex." Alienist and Neurologist, January, 1880; St. Louis Medical and Surgical Journal, February, 1879.

plegia," Alienist and Neurologist, January, 1892.) This subject has also lately been enriched in this country by Dr. F. X. Dercum, in a paper on "Optic Neuritis, Blindness, and the Knee Jerk in Cerebellar Disease," read before the American Neurological Society, July 25.

The important subject of rheumatism affecting the nervous system was embodied in the recent address of Dr. Henry M. Lyman before the American Neurological Association, and attention called to important clinical facts, especially affections of the sensory nervous system, not commonly recognized as associated with this disease. The gastralgias, enteralgias, cutaneous irritations, sensitive feet, and arthritic and cutaneous neuritides of rheumatism have often attracted my attention and have been to me an interesting clinical study, and much more is yet to be written on this important subject.

In the therapeutics of the nervous diseases, as well as in clinical description and pathology, to America belongs much credit for originality and efficiency of discovery and suggestion. Was it not in this country that the great Brown-Séquard first conceived and promulgated his famous treatment for epilepsy, which has done more than all preceding or subsequent therapeutics suggested for the alleviation of this grave malady?

All the now acknowledged virtues of phytolacca decandra, or poke root, except the property of phytoline to reduce corpulency, were brought to my attention through the thesis of a student candidate for graduation of the St. Louis Medical College, in 1859; and Dr. Bealle, an ingenious fellow-graduate from Texas, that same year, told in a thesis, which he entitled "Ups and Downs of a Texas Doctor," how he made a satisfactory flexible bougie out of green slippery-elm bark, how he employed a smooth green wheat straw for a catheter and the crushed potato bug mixed with lard as a satisfactory vessicant in lieu of cantharides, practices which I imitated myself while doing a general country practice in Missouri in 1859 and 1860, when I could do no better, and there is nothing much better for gentle dilatation in certain surgical emergencies than a smooth slippery-elm bougie. I could relate other instances of Western American surgical genius in the use of therapeutic expedients in pressing emergencies of practice were they strictly germane to our subject.

It would require the space of many hours to detail the remedial virtues of our South American flora, beginning with our well-known cinchona. (*Vide* paper on this subject by Dr. J. B. de Lacerda, a colleague of the present congress.) I suggested and used chloral hydrate per rectum in the treatment of convulsive affections, a method based on the West Riding Asylum practice in epilepsy, and used by me for arresting the convulsions of children and of the puerperal state.

Leonard Corning's method of local anæsthesia is original, and we justly claim the discovery and therapeutic application of general anæsthesia as American, Sir James Y. Simpson to the contrary notwithstanding. Copious ether douching for cephalo-spinal pain was practiced by myself thirty years ago. I was the first to employ capsicum, hot coffee and ammonia enemata to resuscitate from profound opium narcosis (*vide* Appendix), after failing with a battery. Kiernan was the next to follow the practice.

In the department of electrotherapy, especially in diseases of the nervous system, America stands well forward in therapeutic suggestion and resource. Beard and Rockwell and their followers in this country have done much in this line. It has been fully thirty years since I first employed the constant current for cerebral and other congestive states, not excepting ovaries and pelvis, and recommended it in gynecology, based on a prior recommendation of Legros and Onimus that it would reduce intrapelvic, sanguineous fluxes. It has been more than twenty years since I began the systematic employment of constant cephalic galvanizations for the cure of insomnia and the treatment of epilepsy, under the conviction that the

prominent symptomatology of both of these affections were dependent upon disorder of vasomotor control, which cephalic galvanizations tend to restore as the bromides do.

Dr. J. B. de Lacerda, of Rio de Janeiro, has offered to this section a paper on "The Condition of Hyperexcitability of the Phrenic Nerve in Beriberi," which is a real addition to the subject. In this connection I may properly mention Dr. Henry M. Lyman's book on Artificial Anæsthesia and Anæsthetics, Insomnia, and other Disorders of Sleep, as a valuable American contribution to these subjects.

We have done no markedly original work in hypnotism, but have some imitators of Charcot and others, as Charcot and his followers have, with professional applause, followed Braid, the professionally tabooed Manchester follower of Mesmer, the mountebank original.

Cataphoresis in neurotherapy has been considerably advanced in America by Corning, Peterson, and others, and likewise the hypodermic use of arsenic by Moyer; also the employment of antipyrin, acetanilid, and other coal-tar derivatives, by the last named and many others. (*Vide* Appendix.)

The therapeutics, as well as semiology, of insanity has been enriched by Jewell and Moyer in this country by treatment directed to the colon. (*Vide* Appendix.)

Nitroglycerin, or glonoin, was first suggested to the regular profession in 1876 and 1878 by Allen McLane Hamilton, before Murrell or others abroad had used it, for anæmic cerebral states and spasms of the cerebral arterioles. It was on this recommendation and the recommendation of nitrite of amyl for a similar purpose that I first employed the latter for the differential diagnosis of supposed hyperæmic from anæmic intracranial states. (*Vide* editorial in Alienist and Neurologist, October, 1888.)

A decidedly original and successful procedure in American surgical neurotherapy is that of pudic neurectomy as a remedy for masturbation, reported by Dr. J. S. Eastman in the Medical News of August 12 of this year. The nerve being more sensitive on this side, Dr. Eastman cut down upon the left pudic nerve, which he found hypertrophied, and removed 3 inches of it. The patient gained weight and was freed from this vice, which had existed from the sixth to the twenty-sixth year. She had been previously sutured in the labia, cauterized, oöphorectomized, and clitoridectomized without benefit.

Veratrum viride, one of the very best remedies I know of for sthenic states of high cerebral and pulmonary congestion, with full, bounding pulse and violent cardiac systole, that is better than the lancet in high-grade apoplexy and pneumonia, as it is fatal to opposite asthenic states of pulmonary inflammation and cerebral congestion, is a distinctly American remedy, and the practice of using it, as well as of abusing its use, is of American origin. It may sometimes well substitute the bromides in certain phases of neurotherapy. I have so employed it. But we must not further dwell specially on American original contributions to neurotherapy. We could not complete the subject in the limits of an ordinary duodecimo volume, while another volume of equal size would not record the real practical progress and unequaled elegance of American pharmacy as applied to our therapeutics.

In the direction of neurological originality and advance the work of our own distinguished Spanish-speaking secretary, Dr. M. G. Echeverria, must not be overlooked. Though his modesty has prevented him from publicly claiming his due reward of merit, his claims have not been overlooked by foreign sources of appreciation. His English publications, notably his great book on Epilepsy, although scarcely noticed by American authors, is much and favorably quoted by neurologists in Germany, England, and France. On their merit he was elected honorary member of the Medico-Psychological Society, of Paris, and of Great Britain and Ireland; also vice-president to the first Congrès International de Medecine Mentale,

held in Paris in 1878, when he was called upon to preside on motion of the late Prof. Lasegue, after the sudden illness of Dr. Baillarger, chairman of the congress. So far as I know, Dr. Echeverria was the first physician in this country who, as professor of nervous and mental diseases, delivered didactic courses of lectures on this subject. This was in 1861, in the University Medical College of New York, while Seguin followed at the College of Physicians and Surgeons, in 1873. On his removal to New York from the National Hospital for the Paralyzed and Epileptic, in London, where he had occupied the position of resident assistant physician with Drs. Brown-Séquard and Ramskill as visiting physicians, he induced the commissioners of public charities and correction to establish the Hospital for Epileptics and Paralytics on Blackwell's Island, New York, under his chief direction, and to found a school for idiots on Randall's Island. Dr. E. Seguin, *pere*, Drs. Kerlin and Wilmarth, of Elwyn, in their literary and practical works as revealed in the pages of the Alienist and Neurologist (*vide* Appendix), together with Dr. Brown, of Barre, Mass., and the Wilburs have certainly done much creditable pioneer work with this class of defectives.

We may here remark, as facts of historical interest, that Dr. Echeverria was the first in America to perform excision of a large portion (2 inches) of the ulnar nerve at the elbow for the radical cure of epilepsy following upon traumatic injury. This operation was performed in 1865, assisted by Dr. J. H. Douglas. In 1869, in the presence of Prof. Boeck, of Christiania, and other physicians and students, he removed, at the hospital on Blackwell's Island, from the base of the second parietal convolution of an epileptic lad, the largest sanguineous clot (1¾ inches long by three-fourths of an inch wide) ever extracted, to that time. This is another operation lately originated abroad. The conical fibrinous clot was deeply imbedded in the cerebral substance, and the patient directly recovered his lost intellectual faculties upon the successful operation. The case is reported in his "Clinical and Anatomo-pathological Researches on Epilepsy," and in a subsequent paper published in Paris in 1878 (Lesigue's Archives Generale), with the records of five similar cases from Dr. Echeverria's own practice, and one hundred and forty, mostly by American and English surgeons. This paper was written mainly to show how unwarranted was the risk of this procedure then ascribed to it by French surgeons. This distinguished neurologist, one of our colleagues to-day, and those I have named before him, will not be overlooked when a candid world enumerates the history of America's neurological benefactors. Worthy of special mention with the foregoing is our indefatigable coworker and colleague, Prof. Charles K. Mills, whom the University of Pennsylvania has so lately honored with its chair of mental and medico-legal medicine. His recent studies in "Lesions of the Superior Temporal Convolution," accurately locating the auditory center, his presentation of the subject of aphasia and other affections of speech in their medico-legal relations, and lesions of the cauda equina, are real advances that must be universally acknowledged, as are likewise the complications of multiple neuritis, and other papers which we present in the Appendix.

And now I name another star which shines in the neurological firmament of New York—a Starr emphatically spelled by his far-seeing parents with a double "r." Among the numerous recent contributions, besides his book on Brain Surgery (published by William Wood & Co., New York), he has given us a special study of "Local Anæsthesia as a Means of Diagnosis of Lesions of the Lower Spinal Cord" (American Journal of Medical Science, July, 1892); "The Cerebral Atrophies of Childhood, with Special Reference to Imbecility, Epilepsy, and Paralysis (New York Medical Record, January, 1892); "Trephining for Hæmorrhage of the Brain Producing Aphasia; Recovery" (Brain, 1892); "Hemianalgesia Alternans" (New York Medical Record, February 11, 1893), and has thrown some new light on the subject of syringomyelia. (*Vide* American Journal of Medical Sciences, May, 1888.) His

book, "Familiar Forms of Nervous Disease," is a credit to any country. Other bright neurological stars are shining, and many have shone longer in the same scientific and humanitarian sky.

It is my impression that Ord's discovery of myxœdema, received its first clinical confirmation in this country, and McLane Hamilton, I think, furnished five of the earliest clinical proofs of its verity as a distinct disease. Hamilton first pointed out the neurogenesis of certain meningeal inflammations, and I have maintained and do yet maintain that hæmophilia is a vasomotor neurosis.

The Alienist and Neurologist (April, 1884, *et seq.*) early maintained that oöphorectomy was too often performed upon the mistaken assumption that the ovary originated nervous disease, whereas the reverse is the most common clinical fact. This is not only an original American claim, but it is now becoming a generally admitted fact both abroad and at home, and the latest and best article on this subject is by Dr. Hamilton, in a late number of the New York Medical Journal.

Another rising luminary of this field is Dr. Frederick Peterson, a reference to whose late contributions (*vide* the Appendix) will interest you and show some good spokes, at least, in the wheel of neurological progress. His recent papers on "Cataphoresis," his physiological experiments with magnetism at the Edison laboratory, and his joint papers with Sachs on "The Cerebral Palsies of Early Life" (Journal of Nervous and Mental Diseases, May, 1890), and other papers to be found in Appendix, are all valuable.

But the stars of this firmament are too many to be counted. Should we dwell long enough to attempt it, we should not during our hour get around the circle. There remains Sachs, who has translated Maynert's Psychiatry for us; Bert Wilder, the brain builder of Ithaca; A. Jacobi, the universal genius; Corning, already mentioned, whose book on Brain Exhaustion is a standard. There is also Dana, to whom we have already alluded, with Carter Gray, whose respective books are abreast of all neurological advance, and in every way creditable to American neurological science. E. N. Brill, Graeme M. Hammond, and Brown of the Journal of Nervous and Mental Diseases, also Ambrose L. Ranney and his standard text-books on Nervous Diseases and Neurological Anatomy, and George I. Stevens with his Belgian Academy prize essays on the "Occulo-neural Reflexes, and the Relation of Eye Strain to Nervous Diseases," whose first article on this subject appeared in the earlier numbers of my journal. Too many stars to classify and minutely describe, but they make a brilliant constellation. If we look back to Philadelphia we discover another neurological star that has escaped our gaze, Horatio C. Wood, whose treatise stands high, and yet another, Dr. A. H. P. Leuff, of neuro-anatomical fame, also Harrison Allen, and there is Wormly, too, of Philadelphia, who is not altogether without the pale, and James Hendrie Lloyd. Far to the southward are Joseph Jones and Sanford Chaille, of New Orleans, and Buckley, of the occidental metropolis.

And now, casting our eye to Baltimore, our vision falls on three luminaries, Miles, Osler, and Hurd, whose light has not shone in vain. There also shine Conrod, Reed, Berkley, Welch, and Halstead of Johns Hopkins Hospital. Skirting the sky northward we come to the Hartford constellation, Stearns and Crothers. The book of the former is devoted to practical psychiatry, the contributions of the latter to that important branch of psychiatry which, through Kerr, Mason, Wright, Crothers, and others, has made such rapid forward strides in the American as well as in the English study of inebriety. The subject of alcoholic trance has been almost exclusively an American neurological study, and Dr. Crothers has contributed more than any other American, perhaps, to make it plain. In the Appendix appears further evidences of American advance in this direction.

I had almost omitted to note the excellent series of articles by Dr. Frank G. Baker, professor of anatomy in the medical department of Georgetown University,

on "Recent Discoveries in the Nervous System," which have appeared in the New York Medical Journal during the current year, and which have been copied into my own journal, from which it appears, in the language of the writer, that all the ideas we have had concerning the development and interrelation of these structures must be revised. The entire nervous system must be reëxamined, the history of every ganglionic center must be traced.

As our vision ranges further, Boston, with its neurological and psychological savants, comes into view—Philip Coombs Knapp and his book on "Intracranial Tumors and Other Diagnoses," Putnam, Channing, Webber, Folsom, John E. Tyler, the departed alienist of Sommerville, and Oliver Wendell Holmes, the poet sage and anatomical and psychological savant of Harvard. The subject of "Arterial Tension in Neurasthenia" received some new light from Boston in 1888 (*vide* article on the subject by Webber, Boston Medical and Surgical Journal, May 3, 1888); likewise the subject of "Lead Paralysis as it Affects the Brain (*vide* same source, October 29, 1891); also the "Condition of the Blood in Certain Mental States" (*vide idem*, March 24, 1892). The same journal for August 29, 1889, also contained some additional light on "Paramyoclonus Multiplex" and other peculiar forms of spasm, and in September of the same year, in same journal, page 277, this American writer throws additional light on the subject of "Cerebral Tumors and their Treatment."

As we continue our survey of the neurological heavens, we come to the constellation Chicago, with such bright, particular, neurological stars as Lyman, with his book on Practice; Kiernan, the polyglot, who has given us good papers on nearly every subject in neurology, and who has especially enriched the subject of morbid erotism in its clinical aspects in the United States; Moyer, the tireless; Paoli, Sanger Brown, Brower, Clevenger, Lydston, and their books; and Church, sadly remembering one bright luminary of these heavens now blotted out, whose light shone for a time upon our particular sky with effulgent luster, Dr. J. S. Jewell. He was a star of the first magnitude, a neurological Jewell of the first water, an indefatigable student, painstaking observer, and a writer of the highest ability. He blotted out his own bright life in the prime of his manhood by overzealous work in the cause he loved above his life. He founded and maintained, while he lived, the Journal of Nervous and Mental Diseases. And this reminds us that we should not omit most honorable mention, in this connection, of the name of Dr. Jewell's worthy and industrious coworker, Dr. H. M. Bannister, among the men of might near Chicago who have contributed to brighten her brilliant neurological sky. Hinde and Moyer have also contributed a paper to "Clonic Rhythmical Spasm of the Pronator Radii Teres" (Journal of American Medical Association, 1887); and Moyer alone has contributed the following additional papers: "Periodically Recurring Oculomotor Paralysis" (The Medical Record, 1887), being the first case described in this country; "Akinesia Algeria" (Medical Standard, 1893), being the sixth case reported and the second in this country, and "A Rare Occupation Neurosis" (Medical News, 1893). By his works ye shall know him. (*Vide* Appendix for much more than we have here noted.) Within almost a suburban radius of Chicago is McBride, of Milwaukee, and his Review of Insanity and Nervous Diseases, and Bannister, of Kankakee, and till lately Patterson, of Batavia, now deceased.

Modesty forbids my dwelling at length upon what St Louis has done for the advancement of neurology. We may recover from our modesty sufficiently to appear in the printed Appendix; however, I might briefly intimate that both Dr. Bremer and myself have within the past few years added something to the literature of "Astasia Abasia;" Fry to "Chorea;" Shaw to the subject of "Trephining for Brain Disease," and Bauduy to the "Study of Alcoholism and its Treatment." This is not all that we have done, but it were better that someone else, non-resident,

should record and comment on our work, and I may say again, as I have said before, *vide* Appendix.

Now, if we continue our survey, we find the sky of neuriatry and psychiatry is not dimmed as we approach the region of the apparently setting sun. On the contrary, bright stars illuminate the western heavens. See how Eskridge shines. He has contributed a valuable paper on "Nervo-Vascular Disturbances in Unacclimated Persons in Colorado" (The Climatologist, March, 1892), the important conclusion of which is for persons on going to the high altitudes of Colorado, especially for those who are nervous or who suffer from pulmonary trouble or cardiac weakness, to live comparatively quiet until they become accustomed to their changed environments. Likewise another on "Chorea in Relation to Climate, Especially the Climate of Colorado" (Climatologist, August, 1891). This study of the effect of the climate of Colorado on chorea shows but little, if any, modifying influence due to altitudes of 5,000 feet to 6,000 feet. Another exceedingly valuable and advance contribution to the literature is "Retro-Anterograde Amnesia, with Report of Two Cases" (Alienist and Neurologist, July, 1892). This is an exceedingly interesting subject, both from a psychological and medico-legal point of view. This is as far as we can go with Eskridge. But he has written much from his high standpoint in the Rocky Mountains, and all is in the line of advanced neurology. (*Vide* Appendix.) Next comes Howell T. Pershing, of Denver, who records five cases of "Preataxic Tabes Dorsalis with Optic Nerve Atrophy," in which there were marked atrophy of the optic nerves with little or no ataxia. He gives a statistical study of tabes, and shows that (as Walton and Gowers have recently claimed) the early occurrence of optic atrophy is in some way associated with an arrested development of the spinal symptoms. This fact modifies the ordinary rules of diagnosis and prognosis. He also records a case of "Jacksonian Epilepsy," with successful operation; no recurrence of the paroxysms more than a year after operation. Other articles by this writer are: "Language and Brain Disease" (Popular Science Monthly, October, 1892), and "Disseminated Sclerosis following Syphilis" (International Clinics, July, 1891). But we can not go further in this manner. If we went hence south to the City of Mexico, thence across the Gulf to New Orleans, thence north to St. Paul, and crossed the continent to San Francisco, we should find working neurologists contributing their quota to the world's neurological and psychological progress.

As I am about to conclude, the proceedings of the July meeting of the American Neurological Association have just appeared in the weekly medical press, and here are its notes of American neurological progress: Besides the president's address and Dr. Dercum's paper, to which I have referred, Dr. Smith Baker's paper on "Heterogeneous Personality;" Matthew Field's, on "Hospital Detention;" Frederick Peterson's, on "Temperature in General Paralysis of the Insane;" Joseph Collin's, on "Changes in the Spinal Cord in old Cases of Infantile Paralysis;" G. M. Hammond's, on "Progressive Muscular Atrophy;" C. L. Walton's "New Method of Reducing Dislocation of the Cervical Vertebræ;" Dana's "Acromegaly, Gigantism, and Facial Hemihypertrophy;" J. J. Putnam's "Thyroidectomy in the Treatment of Graves's Disease;" B. Sach's "Tabes and Syphilis;" Krauss's "New Pedodynamometer;" Drs. Lloyd and Reisman's joint communication on "Infectious Endocarditis with General Septicæmia and Multiple Neuritis;" C. L. Walton's "Tumor of the Angular Gyrus;" Dr. E. D. Fisher's "Autopsy and Report of Congenital Cerebral Hemiplegia;" C. K. Mills's "Lesion of the Thalamus and Internal Capsule;" Wharton Sinkler's "Tumor of the Optic Thalamus;" George J. Preston's paper on the "Localizing Value of Aphasia;" Leonard Weber's, on "Neurasthenia;" Krauss's "Case of Myxœdema, with Observations;" Philip Koombs Knapp's "Simulation in Traumatic Nervous Diseases;" and "The Microbic Origin of Chorea," by Dr. C. L. Dana, are all instructive, suggestive, and progressive in our depart-

ment. The proceedings of this favorite American society are becoming every year more and more valuable. They are indispensable to neurological advance. The neurological world would not march on to its manifest destiny to rule paramount in the world's medical thought without the original work of this great American society of distinguished neurologists. There were also papers read only by title before this body, the names of whose authors are also adequate warranty of worth. Among them, "The Genesis of Hallucination and Illusion," by H. A. Tomlinson, of St. Peter, Minn.; "The Diagnosis of General Paresis," by L. C. Gray, of New York; "Two Cases of Friedreich's Disease," by F. R. Fry, of St. Louis; "The Metapore or Foramen of Majendie in Man and in the Orang-Outang," by Burt G. Wilder; "The Relations of Chorea to Rheumatism," by C. Eugene Riggs, St. Paul; "Experiences in the Use of Testiculine and Cerebrine," by J. J. Putnam, Boston; "Paralysis after Surgical Operations," by V. P. Gibney, New York; "Traumatic Brachial Plexus Paralysis in Infants," by William Leszynsky, New York. If I should go on enumerating the work, present and recent, of American neurologists, it would develop acute cerebrasthenia. It would make you tired. I had almost forgotten to note the contributions of our hospitals for the insane to the pathology of mental diseases. I can not now go entirely over this vast subject. Besides what has been done at Utica, N. Y., and Middletown, Conn., with which you are familiar through the Journal of Insanity, you may not know that it has for a long time been the custom of Dr. J. W. Blackburn, the eminent pathologist of the Government Hospital for Insane, at Washington, to each year select a number of cases for special study as a pathological supplement to the annual reports of the Government Hospital for Insane. This and the making of nearly one hundred post-mortem examinations yearly, constitutes the work of this hospital, to which I also invite your attention in the Appendix. I had almost omitted James Hendrie Lloyd, of Philadelphia, and Theodore Diller, of Pittsburg. You see, America breeds and develops neurologists as the water breeds and develops fishes. The pabulum neurology feeds on is in the American people; their hustling, rushing habits, their business, professional, social, and political environment, and the numerous newspapers they read every morning before breakfast and every night before they forget to say their prayers; this moral, political, social, and business atmosphere of ambition and bustle tends to develop the strongly endowed, neurologically and psychologically, as it tends in the weakly endowed to the development of neuropathic conditions. It develops neurologists and psychologists to care for the neuropaths. It builds and it breaks the nervous system. It can not yet be said that we are a neuropathic people, though we are tending that way; but neurology is advancing with equal pace with neuropathic breakdown, and will, it is hoped, ultimately enlighten and save the people from their neuropathic sins.

Appendix.

Dr. M. Allen Starr:

Diagnosis and Operation for Three Tumors of the Brain (American Journal of Medical Sciences, April, 1893).

Dr. T. D. Crothers:

Law of Periodicity in Inebriety (*vide* Alienist and Neurologist, July, 1892), showing a uniformity in the drink impulse and the laws which regulate it.

Some New Studies of the Opium Disease, read before the Philadelphia County Medical Society, January, 1892, pointing out a neurotic diathesis and various conditions favoring this disease.

Are Inebriates Curable? read before the English Society for the Cure of Inebriety, June, 1892, proving the curability and the periodicity from further study in this direction.

Sanitary Side of the Drink Problem, read before the American Medical Association, June, 1892, discussing the sanitary dangers from neglect of control of inebriates.

Medical Jurisprudence in Inebriety (*vide* International Magazine, February, 1893); an argument to prove the need of new legislation for inebriates.

Dr. T. D. Crothers—Continued.

American Inebriate Asylums, read before the American Medical Association, June, 1893, being a historical review of asylum treatment for inebriates.

Criminal Inebriates and Treatment, read before the Congress of Criminology, June, 1893.

Dr. Frederick Peterson:

Homonymous Hemiopic Hallucinations (New York Medical Journal, August 30, 1890, and January 31, 1891); Disturbances of Sense of Taste after Amputations of Tongue (New York Medical Record, August 30, 1890), and his paper on Gyrospasm of the Head in Infants (Philadelphia Medical News, October 1, 1892), are especially interesting.

Three Cases of Acute Mania from Imbibing Carbon Bisulphide (Boston Medical and Surgical Journal, October, 1892), and upon Physiological Experiments with Magnetism at the Edison Laboratory (New York Medical Journal, December 31, 1892).

Dr. Harold N. Moyer:

Relation of Insanity to Crime (Chicago Law Journal, 1889); The Hypodermic Use of Arsenic (Therapeutic Gazette, January 15, 1891); Differential Diagnosis of Uræmia and Epilepsy (Medical Mirror, 1891), and Nervous Sequelæ of Influenza (Medical Age, 1891). This and the papers of Mills and Gowers, and my own contribution (Alienist and Neurologist), all present new features of this disease and prove it to be a toxic neurosis.

Pathological Work of the Government Hospital for the Insane:

Report of 1887, Supplement, illustrated: Report of post-mortem examinations in thirty-one cases of paralytic dementia, or general paralysis of the insane.

Report of 1888, Supplement: Table showing the post-mortem appearances of the kidneys in two hundred and sixty-three cases of mental disease, giving the age, occupation, nativity, mental disorder, and co-existing physical disease.

Report of 1889, Supplement, illustrated: Report of post-mortem examinations in twenty-nine cases of mental disease. Part I, Fifteen cases of general paralysis and three cases of acute organic dementia. Part II, Eight cases of acute mania and three cases of acute insanity with maniacal symptoms, dependent upon organic brain disease.

Report of 1890, Supplement, illustrated: Report of post-mortem examinations in thirty-nine cases of epileptic insanity. Part I, Twenty-two cases of chronic epileptic mania. Part II, Seventeen cases of chronic epileptic dementia.

Report of 1891, Supplement, illustrated: A study of nineteen cases of general paralysis of the insane.

Report of 1892, Supplement, illustrated: I, Synopsis of post-mortem examinations in seventy-three cases of mental disease in females, with special reference to the condition of the organs of generation. II, Condensed description of the tumors found in five hundred and forty-six autopsies in cases of mental disease in males.

Dr. H. M. Lyman:

Treatment of Neuralgia (Western Medical Reporter, 1889).

Insanity Proceeding from the Colon (Alienist and Neurologist, 1889, and Journal American Medical Association).

Experts and Expert Testimony (Alienist and Neurologist, 1891).

The Neurological portion of Lyman's Text-book on the Practice of Medicine (short papers).

Tetany (Transactions of the Association of American Physicians, Vol. I).

Railway Shock (Transactions of the Chicago Medical Society).

Nervous Dyspepsia (Review of Insanity and Nervous Diseases, June, 1893).

Dr. C. H. Hughes:

A Clinical Inquiry into the Significance of Absent Patellar Tendon Reflex (Alienist and Neurologist, January, 1880).

The Medico-Legal Aspect of Cerebral Localization and Aphasia (Alienist and Neurologist, April and July, 1880).

Reflex Cardiac Gangliopathy with Hereditary Diathesis (Alienist and Neurologist, April, 1880).

Notes on Neurasthenia (Alienist and Neurologist, October, 1880).

Impending Periodic Mania (Alienist and Neurologist, October, 1880).

Nitrite of Amyl—Differential Diagnosis of Cerebral Hyperæmia and Anæmia (editorial, Alienist and Neurologist, October, 1880).

Moral Insanity, Depravity, and the Hypothetical Case (Alienist and Neurologist, January, 1881).

Problems in Psychiatry for the Family Physician (Alienist and Neurologist, January, 1881).

Clinical Notes Illustrative of Consciousness of Epilepsia (Alienist and Neurologist, April, 1881).

Illusion, Hallucination, and Delusion—A Differential Study for Forensic Purposes (Alienist and Neurologist, July, 1881).

Moral (Affective) Insanity (Alienist and Neurologist, January, 1882).

Dr. C. H. Hughes—Continued.

The Special Therapeutic Value of Hyoscyamine in Psychiatry (Alienist and Neurologist, April, 1882).

Note on the Essential Psychic Signs of General Functional Neuratrophia or Neurasthenia (Alienist and Neurologist, July, 1882).

Psychical Analysis of Guiteau (Alienist and Neurologist, October, 1882).

The Therapeutic Value of Cephalic and Spinal Electrizations (Alienist and Neurologist, January, 1883).

The Simulation of Insanity by the Insane (Alienist and Neurologist, July, 1883).

The Opium Psycho-Neurosis—Chronic Meconism or Papaverism (Alienist and Neurologist, January, 1884).

Borderland Psychiatric Records—Prodromal Symptoms of Psychical Impairment (Alienist and Neurologist, July, 1884).

Migraine (Alienist and Neurologist, April, 1884).

Moral (Affective) Insanity (Alienist and Neurologist, April and July, 1884).

The Curability of Locomotor Ataxia and the Simulations of Posterior Spinal Sclerosis (Alienist and Neurologist, July, 1884).

Insanity Defined (Alienist and Neurologist, October, 1884).

The Hygiene of the Nervous System and Mind (Alienist and Neurologist, January, 1885).

State Provision for the Insane (Alienist and Neurologist, April, 1885).

A Case of Psycho-Sensory (Affective or Moral) Insanity (Alienist and Neurologist, April, 1885).

An Outline Brief in the Management of Melancholia (Alienist and Neurologist, April, 1886).

Meconeuropathia (Alienist and Neurologist, July, 1886).

The Curability of Epilepsy and Epileptoid Affections by Galvanism and the Phosphated and Arseniated Bromides (Alienist and Neurologist, January, 1887).

Neuritis Plantaris (a Clinical Record) (Alienist and Neurologist, April, 1887).

The Scientific Rationale of Electrotherapy (Alienist and Neurologist, July, 1887).

The Relation of the Nervous System to Hæmophilia, Malarial Hæmaturia, etc. (Alienist and Neurologist, July, 1887).

A Unique Case of Bi-Lateral Athetosis (Alienist and Neurologist, July, 1887).

The True Nature and Definition of Insanity (Alienist and Neurologist, October, 1887).

The Neural and Psycho-Neural Factor in Gynæciac Disease (Alienist and Neurologist, April, 1888).

Essential Infantile Paralysis (Alienist and Neurologist, October, 1888).

Persistent Spasm of the Levator Anguli Scapulæ Muscle (Alienist and Neurologist, January, 1889).

Neurological Photographs of More or Less Unique Cases Hastily Taken During the Active Practice of a Busy Neurologist (Alienist and Neurologist, April, 1889).

Over-strain and Under-power of Brain (Alienist and Neurologist, October, 1889).

Memorandum of Examination of a Case of Neuro-Myotonia ("Thomsen's Disease"), with Remarks on its Differential Diagnosis (Alienist and Neurologist, January, 1890).

Notes on the Legitimate Sphere of Special Medical Practice (Alienist and Neurologist, April, 1890).

Note on Extra-Neural Nervous Disease (Alienist and Neurologist, July, 1890).

Notes on the Facial Expression of Cerebral (Multiple Cerebro-Spinal) Sclerosis (Alienist and Neurologist, July, 1890).

The Psychopathic Sequences of Hereditary Alcoholic Entailment (Alienist and Neurologist, October, 1890).

Virile Reflex (Alienist and Neurologist, January, 1891).

Psychical or Physical? (Alienist and Neurologist, April, 1891).

Report on Neurology and Psychiatry (Alienist and Neurologist, July, 1891).

The Work of Medicine for the Weal of the World (Alienist and Neurologist, January, 1892).

Virile and Other Nervous Reflexes (Alienist and Neurologist, January, 1892).

Epidemic Inflammatory Neurosis, or Neurotic Influenza (Alienist and Neurologist, April, 1892).

Medical Manhood and Methods of Professional Success (Alienist and Neurologist, July, 1892).

Note on the Hysterical Concomitants of Organic Nervous Disease (Alienist and Neurologist July, 1892).

Insomnia in an Infant, with Reflections on Pathological Sleeplessness (Alienist and Neurologist, July, 1892).

Note on Nervous Disturbances after Removal and Atrophy of Testicles (Alienist and Neurologist, January, 1893).

Remarks on Presentation of Diplomas to the Graduating Class of the Barnes Medical College (Alienist and Neurologist, April, 1893).

Aphasia or Aphasic Insanity, Which? A Medico-Legal Study (Journal of Insanity, January, 1879).

Dr. Chas. K. Mills:

Spinal Localization in its Practical Relations (Therapeutic Gazette, May and June, 1889).

Lesions of the Sacral and Lumbar Plexuses (Medical News, June 15, 1889)

Brain Specimens Chiefly Illustrating Localization (University Medical Magazine, November, 1889).

Lesions of the Cauda Equina (Medical News, March 1, 1890).

Hysteria (Keating's Cyclopedia of the Diseases of Children, Vol. IV, 1890).

Myotonia and Athetoid Spasm (International Clinics, April, 1891); also, Autopsy in a Case of Athetoid Spasm and Myotonia (Journal of Nervous and Mental Disease, December, 1891).

Lesions of the Superior Temporal Convolution Accurately Locating the Auditory Center (University Medical Magazine, November, 1891) [This we regard as the most valuable and recent advance of this important subject.]

Aphasia and Other Affections of Speech in their Medico Legal Relations (Review of Insanity and Nervous Disease, September and December, 1891).

Articles on Apoplexy, Brain Tumor, Spinal Tumor, Meningitis, Cerebritis, and Neuritis (Hare's System of Practical Therapeutics, Vol. I, 1891).

The Nervous and Mental Phenomena and Sequelæ of Influenza (Transactions of the Philadelphia County Medical Society, January 13, 1892)

Multiple Neuritis and Some of its Complications (International Medical Magazine, February, 1892).

Neuritis and Myelitis and the Forms of Paralysis and Pseudo-Paralysis Following Labor (University Medical Magazine, May, 1893).

Dr. Peterson has contributed four papers on Electric Cataphoresis (New York Medical Journal, April 27, 1889, and October 15, 1890; the New York Medical Record, January 31 1891, and the Philadelphia Times and Register, March 21, 1891). This subject has received special elucidation in this country and is receiving more. It is a growing theme

Dr. J. T. Eskridge:

Case of Fracture of the Twelfth Dorsal Vertebra, Followed by Injury to the Spinal and Sympathetic Nerve Supply of the Bowel in the Region of the Ileo-cæcal Valve: Intestinal Hæmorrhage and Death on the Seventh Day (Medical News, October 10 and 17 1891). The interesting feature of the above case is indicated by the title, and consists in the accurate localization of the spinal and sympathetic nerve supply to that portion of the bowel in the region of the ileo-cæcal valve.

Gunshot Wound of the Left Cuneus, with Right Homonymous Hemianopsia (*Ibid*, October 17, 1891). The case, which was carefully studied during the life of the patient, and the lesion accurately examined after death, which occurred a few days after the receipt of the injury, is another proof, if one were needed, of the relation of the occipital lobes to vision.

Myelitis in a Case of Incipient Posterior Spinal Sclerosis (International Medical Magazine, April, 1892). This case is one of posterior spinal sclerosis, which had run a course of several years, when typical symptoms of acute myelitis developed, an extremely rare complication of this chronic affection of the cord.

Acute Myelitis Preceded by Acute Optic Neuritis (Journal of Nervous and Mental Disease, September, 1890). In the report of this interesting case the author gives a short abstract of a number of others somewhat similar to it. One curious feature of the one here reported and of one of Dreschfield's cases is, that the optic neuritis reached its height before the spinal symptoms became manifest.

Poliomyelitis with Perineuritis (New York Medical Journal, December 26, 1891) The chief interest in this case lies in the fact that neuritis complicates poliomyelitis, and is a more frequent complication than was formerly supposed.

Tumor of the Brain (Denver Medical Times, January, 1892). The main interest in this case is in the perverted tactile sense and abolished muscular sense early in the history of the disease, later in the restoration of tactile sense, but the muscular and localization senses remaining completely abolished. The author promises an interesting report when the case is finally put on record in the light of the autopsy.

Some Points in the Diagnosis and Nature of Certain Functional and Organic Nervous Diseases (Alienist and Neurologist, January, 1892). The first part of this paper is occupied with reports of cases illustrating a point in the differential diagnosis of organic spinal lesions from brain and peripheral affections, first brought to the attention of the medical profession by Dr. C. E. Beevor, of England. These cases support the claim of Dr. Beevor in that, by the careful study of the associated and isolated actions of the two parts of the great pectoral muscle, a spinal lesion may be diagnosticated or excluded in doubtful cases. The second part is taken up in a discussion of the subject of Uric Acidemia, so prominently and enthusiastically advocated by Dr. Haig, of London. While the author is far from laying great stress upon this condition in the production of headaches, etc., and its treatment by acids and salicylates, yet he believes there are a number of cases, which, if well selected, much good results by following out Haig's method of treatment.

Dr. J. T. Eskridge—Continued.

Ataxia (International Clinics, January, 1892). The subject which forms the title of this paper is treated of in a systematic manner, and well illustrated by several cases.

Syringomyelia (International Clinics, Vol. 1, second series). This is an elaborate and very thorough report of a case of this curious disease, and in the light of the report of a recent case by J. Hendrie Lloyd, of Philadelphia, with an autopsy, including microscopical sections of the cord, there can be but little doubt that the disease now can be positively diagnosticated during life.

Report of Cases of Moral Imbecility, of the Opium Habit, and of Feigning, in which Forgery is the Offense Committed (Medical News, January 14, 1893). The cases form an interesting medico-legal study.

Traumatic Myelitis (Medical News, March 4, 1893). The report of this case of traumatic myelitis illustrates how thoroughly the cord may be disorganized by concussion of the spine without any injury directly to bones, membranes, or cord. The subject of spinal localization is considered at some length in the report.

Idiopathic Muscular Atrophy (Journal of Nervous and Mental Disease, April, 1893). The infrequency of this disease gives the report its chief interest. The diagnosis is between idiopathic muscular atrophy and muscular atrophy of spinal origin.

Chronic Meningo-Myelitis (Denver Medical Times, April, 1893). The case herein described illustrates the effect of trauma in lighting up latent syphilis.

Dr. Wm. Fuller:

Surgical Shock (Medical Record), Montreal, February, 1877; Physiology of Convulsions, June, 1876; Treatment of Meningitis, August, 1877, and A Case of Cerebral Tubercle, December, 1877. The ideas advanced in these papers were not in accordance with the teaching of the day. In December, 1878, he published a paper in the Detroit Lancet upon Exophthalmic Goitre, referring all the symptoms to pressure and interference with the function of important peripheral nerves rather than to centric or sympathetic disease. Trephining of the Skull in a Case of Idiocy, with Remarks, a paper read before the Medico-Chirurgical Society of Montreal.

Dr. Rohé:

Dr. Rohé, of Catonsville, Md., in inquiring into the relations existing between pelvic disease and psychical disturbances in women (Journal American Medical Association, September 24, 1890), points out the frequency with which bodily conditions influence mental states, and shows that a "torpid condition of the intestines, Bright's disease, putrefactive processes in the intestinal canal, etc., might give rise to melancholia and other disorders of the mental functions."

Dr. Frank R. Fry:

The Sensory Symptoms of Three Spinal Cord Cases (Alienist and Neurologist, July, 1893). The Etiology and Treatment of Chorea (1886). An Analysis of New Cases of Chorea (1889). Chorea in the Aged (1891).

On A Case of Chorea Attended with General Multiple Neuritis (1891).

On The Co-Existence of Chorea and Alien Spasmodic Phenomena (1892).

On A Second Case of Chorea Attended with Multiple Neuritis (1893).

PAPERS READ BEFORE THE SECTION.

PARALYSIE SPASTIQUE CÉRÉBRALE DES ADULTES.

Par le Docteur M. CARMONA Y VALLE, Mexico.

MESSIEURS: La paralysie spinale spasmodique de Erb, ou tabes dorsal spasmodique de Charcot, est une affection qui ne figure que depuis peu de temps dans le cadre nosologique.

C'est en 1875 que ces deux auteurs crurent la découvrir et la rapportèrent à une sclérose primitive des cordons antéro-latéraux de la moelle. Depuis cette époque tous les traités spéciaux de pathologie la décrivent comme telle et dans toutes les cliniques on entendit parler de sclérose primitive des cordons antéro-latéraux de la moelle.

Malheureusement, l'anatomie pathologique n'est pas venue sanctionner ces vues purement théoriques, car dans aucune des autopsies faites jusqu'à ce jour, on n'a pu démontrer l'existence de la sclérose isolée du faisceau pyramidal. Tantôt on a trouvé de la sclérose en plaques, tantôt de la sclérose latérale amyotrophique, tantôt, enfin, de la myélite transversale ou en foyer.

Charcot lui-même, dans ses leçons de 1880, dit que jusqu'alors on n'avait pu prouver la dégénérescense primitive dans les prétendus cas de tabes dorsal spasmodiques.

Le Dr. Pierre Marie, dans ses belles leçons sur les maladies de la moelle, publiées l'an passé, propose de conserver la dénomination de tabes dorsal spasmodique autant pour rester fidèle à son maître Charcot que pour ne pas introduire de confusion dans le langage scientifique actuel; mais cette dénomination ne s'appliquerait plus à la sclérose primitive du cordon pyramidal, mais à l'arrêt de développement de ce faisceau, consécutif avec accouchements prématurés, ou aux accouchements dystociques lorsque la tête a séjourné longtemps dans l'excavation. De sorte que le tabes spasmodique serait toujours une maladie congénitale, ne se développant jamais après la naissance.

Ce fut Heine qui parla le premier, en 1840, de la maladie ainsi comprise: il la dénomma paraplégie spastique cérébrale, et plus tard Little l'étudia avec plus de soin et l'appela rigidité spastique congénitale des jambes. D'autre part, Benedikt décrit l'hémiplégie spastique infantile comme une maladie propre à la première enfance, caractérisée par l'apparition de phénomènes aigus d'origine cérébrale, auxquels succède une hémiplégie spastique plus ou moins marquée qui dure toute la vie. Les membres paralysés subissent un arrêt de développement, et il est très fréquent de voir ces enfants devenir plus tard épileptiques.

Strümpell incline à croire que cette maladie est due à l'inflammation de la substance grise des centres psicho-moteurs et l'appelle polio-encéphalite par analogie avec la polio-myélite des cornes antérieures. Hirt rapporte plusieurs cas de cette affection et lui refuse la dénomination proposée par Strümpell en se fondant sur ce fait que les autopsies ont montré que les lésions morbides ne sont pas limitées à la substance grise, mais qu'elles s'étendent aussi à la substance blanche. Cette opinion qui peut paraître très rationnelle perd cependant beaucoup de sa valeur quand on considère que le faisceau pyramidal (substance blanche) a son centre

trophique dans les cellules des centres psicho-moteurs. Par conséquent, si ces cellules sont détruites les fibres du faisceau pyramidal doivent s'atrophier et perdre leurs caractères normaux. En d'autres termes, la lésion de la substance blanche ne peut pas être primitive, mais, au contraire, consécutive à l'altération de la substance grise.

Quoi qu'il en soit, et pour en revenir à notre historique, nous pouvons admettre : 1° que la science possède actuellement des raisons très fortes pour mettre fortement en doute l'existence de la sclérose primitive des cordons antéro-latéraux ou du tabes spasmodique, tels que les décrivirent en 1875 Erb et Charcot; 2° que l'on admet aujourd'hui que la paralysie spasmodique au sens rigoureux du mot reconnaît trois origines: (*a*) Une lésion médullaire seule, sclérose antéro-latérale amyotrophique; myélite transverse ou myélite en foyer; (*b*) Une lésion purement cérébrale, paraphlégie spastique cérébrale de Heine ou rigidité spastique congénitale des jambes de Little, et enfin l'hémiplégie spastique infantile de Benedikt.

Comme on le voit, on admet donc aujourd'hui que la paralysie spastique d'origine cérébrale est, ou bien congénitale et due à un arrêt de développement du faisceau pyramidal, ou bien encore une maladie acquise mais propre à la première enfance.

Je viens démontrer que la paralysie spastique d'origine cérébrale n'est pas une affection propre à la première enfance, mais qu'elle peut aussi survenir chez l'adulte.

Observation 1.—Docteur J. G., né à Mexico, âgé de 50 ans, marié, de bonne constitution et sobre. A la fin de l'année 1887 il opérait un malade qui portait des végétations sur la verge. Pendant l'opération faite sous le chloroforme le malade fit un mouvement brusque et une goutte de sang entra dans l'œil droit de l'opérateur. Il se forma en ce point un ulcère chancreux qui mit assez longtemps à disparaître. Le ganglion préauriculaire et ceux de la partie postérieure du cou devinrent volumineux et douloureux mais ne suppurèrent pas. Quelques mois après, il survint sur les membres une éruption que le malade qualifia d'ectyma; mais le Dr. Valenzuela, qui alors le soignait, m'a assuré que cette éruption était banale et qu'elle n'avait pas les caractères de syphilides.

Actuellement il n'y a aucune tache sur les membres, et nulle manifestation secondaire ne s'est montrée depuis.

Trois ans plus tard, en 1890, pendant qu'il se trouvait dans un village de l'État de Michoacan, J. G. eut une attaque de céphalalgie extrêmement intense, accompagnée de nausée et de vomissements fréquents, entièrement apyrétique et qui disparut au bout de quinze ou vingt jours sous l'influence d'un traitement iodo-mercuriel.

Peu de temps après, et de retour à Mexico, un jour qu'il se trouvait dans son cabinet de consultation, il remarqua qu'il balbutiait en parlant, que la plume lui tomba de la main; il se sentit faiblir et enfin il perdit connaissance. Il n'eut pas de convulsions, ne poussa pas de cri, ne se mordit pas la langue et au bout de quelque temps il put reprendre ses occupations; mais il sentit ses jambes faibles et éprouva des engourdissements dans les trois derniers doigts de la main droite et les deux premiers de la gauche. Tous ces symptômes disparurent en quelques heures sans laisser de traces. Des attaques semblables se répétèrent de temps en temps, mais il m'a été impossible de fixer leur nombre non plus que l'intervalle qui les a séparées. Entre les attaques, il éprouva des troubles du goût et de l'olfaction, des diplopies passagères, des sensations de vertige comme s'il était sur le point de tomber dans un précipice. Après une des attaques, il resta momentanément avec la bouche déviée d'un côté qu'il ne peut préciser. Après une autre, il devint hémiplégique du côté gauche, mais le mouvement revint promptement et le malade revint complètement à la santé.

Enfin, le 24 juin 1891 il éprouva l'attaque la plus forte qu'il ait jamais eue, celle qui l'a laissé dans l'état où on le voit aujourd'hui, et qui, il faut le noter, fut la dernière. La perte de connaissance dura cette fois plus de 24 heures, il y eut du trismus, aucun aliment ne peut être avalé. Quand il revint à lui, il était complètement paralysé; il ne pouvait mouvoir aucun de ses membres et le cou même était complètement immobile. La rigidité de son corps était telle que, parfois, il se croyait atteint de tétanos. Les lèvres, la langue, et les yeux étaient les seules parties du corps qu'il pouvait mouvoir librement; la parole et la déglutition étaient normales. La respiration était difficile, mais cette difficulté ne provenait pas de la paralysie du diaphragme ou des muscles respiratoires du thorax, elle

était due à la rigidité, à la contracture des membres supérieurs. Les avant-bras en flexion forcée sur les bras et les mains sur les avant-bras comprimaient si fortement le thorax que souvent il pensait suffoquer. Il avait perdu complètement la notion de la position de ses membres; parfois il croyait avoir ses jambes en l'air et il fallait qu'une personne les lui touchât pour qu'il se rendît compte de leur véritable position. Malgré cela, il sentait les mains qui le touchaient, les piqûres de puces et les changements de température. Au début, il perdait les urines et les excréments sans en avoir conscience; mais peu à peu son état s'est amélioré, le sentiment de ces besoins naturels est revenu, mais de temps à autre il n'a pas la force suffisante pour retenir ses urines.

Je vis ce malade au mois de juillet 1892, treize mois après la dernière attaque, et sa situation n'a pas changé sensiblement. Jamais, il est vrai, il n'a voulu s'astreindre à suivre d'une façon soutenue un traitement rationnel.

Je le trouvai couché dans son lit en position supine, le drap-de-lit le couvrait jusqu'au cou, les cheveux et la barbe extrêmement longs, plus gros que je ne l'avais connu, d'un coloris excellent, la face animée, la parole facile, mais se fatigant quand il parle beaucoup. Il mange admirablement, ses digestions sont normales, il ne souffre aucune douleur, et il affirme que sans sa paralysie il serait parfaitement bien.

Il rend un compte exact de toute sa maladie; on remarque cependant qu'il n'a pas noté ou qu'il a oublié les dates d'apparition ou le mode de succession de quelques uns des phénomènes les plus saillants de son mal.

Tout mouvement volontaire du cou, des bras, des jambes est impossible. En le découvrant, on voit qu'il est complètement nu, ce qui vient de l'impossibilité où l'on est de remuer ses membres. Les bras et les avant-bras sont intimement unis à la cage thoracique, les avant-bras fléchis sur les bras, les mains sur les poignets, les doigts rapprochés sont en flexion légère, non déformés. La pression exagérée qu'au début de l'affection les membres supérieurs exerçaient sur le thorax et qui gênait la respiration n'existe plus, cependant il n'est pas encore possible de séparer les bras du tronc, ni d'étendre l'avant-bras sur le bras.

Le malade croit qu'il commence à mouvoir les doigts de la main droite, mais à l'examen on remarque un glissement si léger qu'on doute s'il est réel ou apparent. En employant une force suffisante, on arrive à vaincre en partie la contracture sans provoquer de douleur, mais il est absolument impossible de placer les bras dans leur position normale.

Les jambes sont en extension forcée, les pieds complètement étendus sur les jambes et en légère rotation en dedans, les deux jambes rapprochées avec une tendance marquée à l'adduction. Il est absolument impossible de fléchir le pied sur la jambe, et par conséquent de rechercher l'existence du phénomène du pied. En déployant une certaine force, on peut fléchir la jambe sur la cuisse et celle-ci sur le bassin. Dans cette position, le malade peut volontairement glisser le pied sur le matelas et étendre la jambe, mais le mouvement volontaire de flexion est impossible. Lorsqu'on fléchit les deux jambes du malade, il reste quelques instants dans cette position, mais tout d'un coup elles s'étendent d'une manière brusque et énergique.

Les muscles sont parfaitement bien developpés et les membres des deux côtés symétriques. La sensibilité à la douleur et la sensibilité thermique sont normales. Quant à la sensibilité tactile, il existe quelque chose d'anormal, car bien que le malade sente parfaitement la main d'une personne qui le touche, cependant, il ne peut toujours définir si un corps est rude ou lisse et quand on le touche doucement avec un objet dont la température est à peu près celle de la peau, il ne se rend pas facilement compte de cette sensation.

La vue, l'ouïe, l'odorat et le goût sont parfaitement normaux.

Actuellement, en juin 1893, je sais que ce malade est dans le même état qu'il y a un an au moment où je l'observai.

Ce cas nous offre un exemple parfait et complet de paralysie spastique, tel que le décrit P. Marie dans le cas d'arrêt de développement du faisceau pyramidal. De plus, cette paralysie est survenue après des accidents cérébraux manifestes: vertiges, troubles de l'olfaction et du goût, diplopies, paralysie du facial, hémiplégie, pertes de connaissance, etc.

Observation 2.—Hôpital de Jésus, lit N°. 1, département réservé. José María Romero, âgé de 34 ans, de race indigène, prêtre du diocèse de Chilapa, de bonne constitution et d'antécédents irréprochables, entra à l'hôpital le 4 mai 1891.

Il raconte qu'il n'a eu comme maladies antérieures que les fièvres intermittentes et qu'il y a cinq ans, en 1886, il commença à remarquer qu'il se fatiguait facilement en marchant et que cette fatigue disparaissait par le repos. Une nuit il sentit des fourmillements dans le pied gauche, des soubresauts des tendons et de la rigidité de la jambe en marchant. Le jour suivant il éprouva des phénomènes

analogues dans la jambe droite. En marchant il traînait les pieds, les jambes lui tremblaient et il croyait marcher sur de la laine. Très peu de temps après il remarqua qu'il parlait avec difficulté; dans cet état il souffrit une violente céphalalgie et eut du délire, il croit qu'il a eu de la fièvre, mais il ne peut l'assurer car on n'a pas pris la température. On l'enferma dans une chambre et il ne recouvra conscience de lui-même qu'au bout de quinze jours. Il se trouva alors complètement paralysé et dans l'impossibilité de prononcer un seul mot. Il avait le cou rigide, il ne pouvait exécuter un seul mouvement ni avec les bras, ni avec les jambes; la déglutition était difficile au point qu'il ne pouvait avaler les liquides que très lentement; il perdait ses urines sans s'en apercevoir; la constipation était tenace.

Peu à peu il recouvre l'usage de la parole, mais il conserva une façon de parler que je décrirai plus tard. La perte involontaire de l'urine dura huit mois et cessa ensuite définitivement. Les mouvements du bras gauche revinrent peu à peu et ce membre quoique lourd, lui est aujourd'hui assez utile. Le bras droit s'est amélioré, mais ses mouvements sont très limités. Il y a une impotence complète des jambes et depuis cinq ans il n'a pu faire un pas. Il n'a jamais eu de nystagmus, ni de tremblements intentionnels dans son unique membre utile.

C'est un homme moyennement développé, mais non affaibli; son visage est animé et d'un coloris normal; il mange avec appétit et digère bien. Il passe ses journées couché dans son lit ou assis dans un fauteuil; pour changer de place il faut qu'un homme le porte, car depuis cinq ans il n'a fait que quelques mouvements limités. Les jambes sont en extension forcée, entièrement rigides et en adduction. Tous les muscles adducteurs sont en contraction et forment un relief notable. Quand le malade est couché, il peut quoique avec peine fléchir la jambe sur la cuisse et celle-ci sur le bassin, mais quand il veut se mettre sur pied, il survient une rigidité si forte qu'il doit y renoncer. Ce phénomène qui est constant chaque fois qu'il veut appuyer les pieds par terre survient aussi souvent quand il est couché. Plusieurs nuits, il est arrivé que ces spasmes ou convulsions toniques sont devenus si violents que, les pieds se trouvant appuyés au mur ou sur le fer du lit, le tronc a été repoussé avec tant de force que plusieurs fois le malade est tombé du lit.

Le bras droit est très lourd, sujet à des contractures et secousses fréquentes; les doigts sont en demi-flexion, le malade peut les mouvoir volontairement, mais avec beaucoup de difficulté. Le bras gauche a des mouvements plus faciles; bien qu'il soit légèrement rigide, est pourtant le membre le plus utile dont puisse faire usage ce pauvre malade.

Assis sur son fauteuil, devant une table, il peut écrire assez bien. Pour écrire, il place le bras droit sur la table et avec la main gauche il place la plume dans les doigts de la main droite qui sont en demi-flexion. Il écrit ainsi lentement mais assez lisiblement.

Les muscles répondent bien aux courants électriques; l'exitabilité électrique est cependant exagérée. Les réflexes tendineux sont extrêmement exagérés dans les deux membres inférieurs et dans le bras droit; ils le sont moins dans le bras gauche, mais toujours plus marqués que dans l'état normal.

La sensibilité dans toutes ses formes est normale.

La manière de parler de ce malade est très singulière. Il n'oublie aucune parole ni aucune nuance de la langue, mais à chaque instant, presque à chaque mot, il éprouve le besoin de s'arrêter et de faire une inspiration forcée; il ouvre la bouche et contracte énergiquement les muscles du cou et les inspirateurs thoraciques. Ces mouvements ressemblent tout à fait aux inspirations ultimes des moribonds. On dirait que les muscles inspirateurs participent au spasme si marqué des muscles des membres. Cette manière de parler rend les réponses du malade extrêmement lentes et causent de l'angoise à la personne qui les écoute. Peu à peu apparurent les phénomènes du décubitus; il se forma des escarres dans tous les points saillants du corps. Le malade alla s'épuisant jusqu'à la mort qui survint au mois d'avril 1893, après 6 ans de souffrances.

Malheureusement quand ce prêtre mourut, j'étais malade, incapable de me rendre à l'hôpital; ses parents s'opposèrent à l'autopsie et l'on perdit ainsi une occasion de faire progresser quelque peu l'anatomie pathologique.

Ce travail deviendrait trop long, si je voulais, après chaque observation, me livrer à toutes les considérations que chaque cas comporterait. Qu'il me suffise pour cette fois de signaler le fait qu'après quelques phénomènes prodromiques, tels que faiblesse des jambes, soubresauts des tendons, fourmillements, etc., et peu après difficulté de la parole, tout à coup il survint des accidents cérébraux bien nets: céphalalgie intense, perte de connaissance, délire et peut-être de la fièvre.

Puis, le tableau change, et il reste une paralysie spastique peut-être plus étendue que celle de la précédente observation, car à la paralysie des quatre membres vint s'ajouter de la disphagie et des troubles de la parole. En revanche, la paralysie du Dr. G—— a été plus complète et plus durable que dans le cas présent puisque ce prêtre recouvra en grande partie le mouvement du bras gauche et que le droit lui permettait, mais difficilement, d'écrire.

Les observations suivantes, recueillies à l'hôpital de Saint-André par mes élèves de la clinique de cinquième année, sont des cas où les malades plus heureux ont recouvré une grande partie de leurs mouvements. J'abrégerai ces observations pour ne pas sortir des limites de ce travail.

Observation 3.—Hôpital de Saint-André. Joseph Barragan, âgé de 28 ans, de constitution vigoureuse, entra à l'hôpital le 1er février 1892. Pas d'antécédents héréditaires; il a deux fils bien portants; il en a eu deux autres mort-nés; il a eu les fièvres éruptives propres à l'enfance et des fièvres intermittentes. Il avait 19 ans quand il devint soldat; un an après, il eut les premiers accidents de la syphilis, suivis de manifestations buccales et pharyngiées; de douleurs rhumatoïdes et plus tard d'une exostose de la clavicule droite.

En 1888, à l'âge de 23 ans, il fit une chûte de cheval, il tomba de côté et il assure que sans avoir reçu de coup à la tête, il resta cependant un peu étourdi; mais au bout de peu de temps, il put se relever et se remettre à cheval.

Huit jours après cet accident, il eut une grande dispute avec un de ses camarades et la nuit suivante en faisant son service il eut à supporter le froid et la pluie.

Cette nuit-là il éprouva une forte douleur dans toute la tête, qui, augmentant de plus en plus, l'obligea à se coucher. Le lendemain, aux premières heures du jour, il nota que sa jambe droite était très lourde, agitée de secousses et que peu à peu la parésie envahit le bras du même côté. Ensuite le mal gagna la face, la bouche se dévia, les yeux se tournèrent produisant de la diplopie. Le jour suivant l'hémiplégie était complète, il perdit la parole, mais pendant quelques heures seulement. Peu de temps après il put parler, mais la parole resta lente et difficile.

C'est dans cet état qu'il fut apporté à l'hôpital militaire où il resta deux mois soumis au traitement ioduré. Il en sortit parfaitement guéri.

Il quitta l'état militaire et prit le métier de charcutier qu'il exerça pendant deux ans et demi en parfait état de santé. Il y a sept mois, sans cause connue, l'attaque revint avec les mêmes caractères que la première fois. Mais cette fois il resta chez lui sans se soigner et le mal empira. La paralysie du côté droit devint plus complète et rapidement la jambe gauche fut envahie, la sensibilité restant complète. Dès le commencement les membres paralysés furent pris par des spasmes, et des rigidités musculaires apparurent à la partie interne des cuisses et postérieure des jambes. Les seuls symptômes qui ne tardèrent pas à disparaitre, furent le strabisme et la déviation de la bouche; la parole est restée lente.

C'est dans cet état qu'il entra à l'hôpital Saint-André à la date mentionnée plus haut.

Quand nous l'examinâmes, il avait la paralysie spastique la mieux caractérisée des deux membres inférieurs et supérieurs droits. La paralysie était plus marquée aux membres inférieurs qu'aux supérieurs. Il ne pouvait se mettre sur pied, parce que lors qu'il voulait le faire, ses jambes devenaient rigides et tremblantes. Le bras droit était impotent, rigide et en demi-flexion; les doigts moitié fléchis étaient peu mobiles. Il ne pouvait saisir un objet qu'avec difficulté et alors le bras était pris de secousses. L'élève qui prenait cette observation qualifiait ces mouvements de tremblement intentionnel de la sclérose en plaques. Mais après examen il fut démontré que ces mouvements n'avaient pas le caractère de ce tremblement, mais que c'était plutôt la trépidation qui s'observe dans le cas d'exagération des réflexes tendineux. Pour ne pas me répéter je ne m'attarde pas à signaler les contractures exagérées des muscles adducteurs des extrémités inférieures, ni la position de ses extrémités, ni à détailler l'exagération de tous les réflexes tendineux dans chacun des membres affectés. Je dois cependant rapporter que le bras gauche, quoique un peu faible, jouissait de tous ses mouvements et que c'était le seul membre utile de ce pauvre malade.

Dans tous les membres malades l'excitabilité électrique était manifestement exagérée.

La sensibilité tactile, à la douleur, à la température était conservée; mais la sensibilité musculaire était quelque peu pervertie. Il avait une conscience parfaite de la position de ses membres, mais il avait perdu la notion du poids et il lui était impossible de distinguer les poids plus ou moins lourds qu'on lui faisait supporter.

Ce malade resta à l'hôpital presque un an. Bien que légèrement amélioré, puis qu'il pouvait faire quelques pas avec beaucoup de difficulté, il sortit presque dans le même état où il était entré.

Observation 4.—Hôpital de Saint-André. Jean Caravantes, âgé de 30 ans, employé de chemin de fer, sans antécédents héréditaires, de condition moyenne, n'a jamais abusé des boissons alcooliques, n'a jamais eu d'affections vénériennes ou syphilitiques.

Il a eu une pneumonie et quelques autres maladies fébriles qu'il ne peut spécifier.

Le 24 avril 1890 il éprouva tout-à-coup une sensation de pesanteur dans l'épaule gauche qui l'obligea à s'incliner de ce côté et ensuite à s'assoir. Ne se trouvant pas bien dans cette position, il dut se coucher. Ce malaise dura peu, mais depuis lors cet accident se répétait plusieurs fois par jour, et de plus il nota qu'à ces moments-là, la jambe gauche, extrêmement rigide, se plaçait en extension ce qui rendait la marche impossible. Il passa ainsi six jours avec ces attaques qui passaient et revenaient plusieurs fois par jour; le septième il sentit la même pesanteur à l'épaule droite, mais la jambe de ce côté ne devint pas raide. Le 4 mai il eut dans la matinée un frisson intense qui fut suivi d'une forte fièvre et de délire. Il passa ainsi tout le jour et toute la nuit, et en se réveillant le matin du 5, il se sentit si frais qu'il voulut se lever, mais à sa grande surprise, il ne put y arriver parce qu'il se trouva complètement paralysé des quatre membres. Non seulement il ne put s'assoir, mais on dut le faire manger parce qu'il ne pouvait faire aucun mouvement. Trois jours après, il commença à sentir dans la jambe gauche des picotements qui étaient suivis de mouvements involontaires. Ces mêmes symptômes apparurent rapidement dans la jambe droite. Les bras qui étaient aussi le siège de mouvements involontaires les premiers jours, recouvrèrent rapidement leurs mouvements volontaires, mais les jambes restèrent impotentes. Quinze jours après l'attaque, il quitta le lit, et pour faire quelques pas il fut nécessaire que deux personnes le soutinssent; les jambes étaient rigides, et il traînait beaucoup les pieds en marchant. La sensibilité était normale.

Il resta dans cet état sans changement notable jusqu'au mois d'août, il perdit alors complètement le sommeil et eut dix jours d'insomnie absolue. Alors survinrent des convulsions générales et une perte absolue de la parole. Les convulsions générales s'arrêtaient de temps en temps, mais revenaient chaque demi-heure ou chaque heure au plus. Il resta dans cet état deux jours; le troisième, il perdit complètement connaissance et resta ainsi un certain nombre d'heures. Il revint à lui et peu à peu il recouvra l'usage de la parole de sorte que quinze jours après il se retrouva avec sa paralysie comme avant.

Au mois de septembre il eut une nouvelle attaque de convulsions générales, mais cette fois elles durèrent moins de temps et il n'eut ni troubles de la parole, ni perte de connaissance. Il resta chez lui sans autre accident que l'impossibilité de la marche et en février 1891 il entra à l'hôpital Saint-André. Nous pûmes alors observer la paralysie spastique la plus complète. Les jambes étaient rigides et en adduction. Si on levait une de ses jambes et si on la laissait tomber, elle se croisait avec celle du côté opposé; les réflexes tendineux étaient très exagérés; l'excitabilité électrique augmentée, les sphincters normaux; il existait un phénomène curieux qui révélait l'exagération de quelques réflexes cutanés. Si pendant la miction une des cuisses venait à toucher le vase, la sensation de froid provocait l'arrêt de l'écoulement de l'urine et la miction ne pouvait continuer qu'au bout d'un certain temps et avec de grands efforts. En dehors de cet accident la miction s'exécutait bien. Quand le malade aidé de deux personnes se mettait sur pied, les jambes devenaient plus rigides et s'agitaient en mouvements trépidatoires; il traînait les pieds, faisait des pas très courts et le pied qu'il voulait avancer se croisait devant l'autre.

Les membres supérieurs jouissaient de tous leurs mouvements, et la sensibilité sous toutes ses formes était physiologique sur toute l'étendue de la peau.

On le soumit à l'usage de l'iodure de potassium et son état s'améliora peu à peu. Il commença à marcher à l'aide de roulettes, puis avec des béquilles et ensuite en s'appuyant sur une canne. Il sortit dans cet état de l'hôpital au mois d'août de la même année, et il resta ainsi jusqu'au 17 janvier 1892. Ce jour il eut des frissons intenses, suivis de fièvre et de douleurs aiguës dans la région lombaire. La fièvre dura quelques heures et cessa ensuite pour revenir le lendemain à 7 heures du matin et disparaître à 11 heures du matin.

Pour ce motif il revint à l'hôpital Saint-André. On lui donna un peu de quinine et la fièvre disparut rapidement. Il marchait alors avec un peu plus de difficulté que lorsqu'il sortit au mois d'août. On le soumit de nouveau au traitement ioduré, on lui donna du calomel jusqu'à production de gengivite légère, on lui mit des vésicatoires à la nuque.

A l'aide de ce traitement, il s'améliora peu à peu, jusqu'à pouvoir marcher sans canne; mais il continua à ne pouvoir faire que des pas très courts, et il garda les jambes raides. C'est dans cet état qu'il sortit de l'hôpital Saint-André en novembre 1892.

En janvier 1893 il entra à l'hôpital de Jésus presque dans le même état que lorsqu'il était sorti de l'hôpital de Saint-André. Il suivit le même traitement que celui qu'on lui avait administré dans cet hôpital. Caravantes s'améliora un peu plus. Ses pas étaient un peu plus grands, mais les jambes restèrent rigides et en marchant c'est à peine s'il fléchissait les articulations du genou.

Au mois d'avril il sortit de l'hôpital de Jésus et depuis lors on le perdit de vue.

Observation 5.—Hôpital Saint-André. Augustin Barron, né à Veta-Grande, Zacatecas, âgé de 30 ans, commerçant. Pas d'affection du système nerveux chez ses ascendants. De bonne santé habituelle, mais a un peu abusé de l'alcool et des relations sexuelles. Il y a eu des accidents vénériens, mais pas de manifestations générales, et en effet on ne trouve ni pleiade ganglionnaire, ni vestiges dans la gorge ou sur la peau.

A la fin de décembre 1881, après un repas assez copieux, il se sentit indisposé de l'estomac, mais il y fit peu d'attention et se coucha. Il ne sait si dans la nuit il eut quelque attaque, mais le lendemain quand il se réveilla, il éprouva une douleur de tête extrêmement forte et vomit les aliments de la veille. De plus il était complètement paralysé et il ne pouvait mouvoir aucun de ses quatre membres. La bouche était déviée du côté droit, l'intelligence et la parole étaient normales. Il a été impossible d'obtenir des dates précises sur la marche qu'ont suivi ces accidents; le malade assure cependant que les mouvements reparurent rapidement dans le côté droit et que le côté gauche resta paralysé plus longtemps, jusqu'à la moitié de février, où il se trouva bien portant et reprit ses occupations.

Il continua à abuser de l'alcool et du coït, quand en 1883 il eut une nouvelle attaque semblable à la précédente. Cette fois, cependant la céphalalgie fut beaucoup plus intense et durable; les vomissements plus tenaces. La bouche ne fut pas déviée, mais la paralysie fut générale.

On le porta en voiture à Zacatecas et il se rappelle qu'en route il voyait les objets doubles. Arrivé à la ville, il reconnut les personnes qui le reçurent, mais quelques heures après il perdit entièrement conscience et ne revint à lui que deux mois après. Sa famille ne lui dit rien de ce qui s'était passé durant ce temps. Il sait seulement qu'on lui mit un vésicatoire sur le ventre et qu'on lui coupa les cheveux parce qu'il lui était venu une éruption à la tête. Quinze jours après avoir recouvré connaissance, il put commencer à se lever aidé de quelques personnes, car la perte absolue de mouvement dans la jambe gauche le mettait dans l'impossibilité absolue de marcher. La jambe et le bras droits jouissaient de tous leurs mouvements; le bras gauche était faible mais les mouvements y étaient assez faciles; seule la jambe de ce côté était complètement immobile.

Notre malade revint en voiture à sa ville natale et peu à peu les mouvements de la jambe gauche revinrent, jusqu'à la guérison complète.

Trois ans après, en 1886, il eut une autre attaque pareille aux précédentes, mais d'intensité et de durée moindres. Depuis cette date jusqu'en 1890, il eut quelques petites attaques, comme il les appelle, et qui consistent en une subite lourdeur de la jambe et du bras droits accompagnée de sensation de chaleur ou de froid, de fourmillements et surtout de rigidité et de soubresauts de tendons dans la jambe.

Ces symptômes duraient un ou deux jours et disparaissaient complètement.

Un jour de l'année 1890, il nota en se levant que ses mouvements étaient très difficiles et alors il résolut de se faire transporter à Aguas-Calientes pour y prendre les bains. Il y resta 8 jours et remarquant que son état ne s'améliorait pas, il revint à Veta-Grande, où un matin il se trouva complètement paralysé, ne pouvant mouvoir même la tête. Il resta dans cet état 8 jours, au bout desquels il recouvra peu à peu les mouvements du cou et des membres du côté droit. Plus tard il recouvra les mouvements du bras gauche, mais depuis lors jusqu'à la date du 20 avril 1892 il n'a pu marcher à cause de l'impotence complète de la jambe gauche. Il a noté que depuis lors ce membre est resté complètement rigide; que cette rigidité diminue beaucoup quand il est couché; dans cette position il peut fléchir la jambe et la mouvoir avec une certaine facilité; mais aussitôt qu'il essaye de l'appuyer sur le sol, elle s'étend fortement, avec des secousses, et il lui est impossible de faire un seul pas. Fréquemment ces spasmes surviennent même lorsqu'il est couché.

Le bras gauche jouit de tous ses mouvements; mais de temps en temps il devient rigide; et quelquefois l'avant-bras s'est placé en extension forcée sur le bras; le premier en pronation, le pouce en adduction et flexion, les autres doigts fléchis sur les précédents.

Le 20 avril 1892, jour de l'entrée de ce malade à l'hôpital, on constata qu'il jouit de toutes ses facultés. Il parle parfaitement bien, et il meut ses deux membres supérieurs et l'inférieur droit comme une personne bien portante.

Couché en position supine, il a la jambe gauche rigide et en extension et adduction; le pied en légère extension et les orteils fléchis; les tendons extenseurs des orteils font un grand relief sur le dos du pied. Les muscles de la partie interne de la cuisse sont en contraction et forment une saillie notable. Aucun mouvement anormal.

Si l'on demande au malade de fléchir la jambe, il peut le faire mais avec grande difficulté parce qu'il avait à lutter contre la contraction des muscles extenseurs de la jambe sur la cuisse. L'exécution du mouvement commandé permit de noter la prépondérance d'action des muscles adducteurs et du tibia antérieur, car le membre est porté en adduction et le bord externe du pied est plus élevé que le bord interne. L'expérience ne peut pas être recommencée, car le malade ne peut répéter le mouvement, la contracture des muscles extenseurs s'y opposant.

Après quelques moments de repos, Barron peut fléchir la jambe, l'étendre et la porter sans grande difficulté dans la direction qu'on lui indique. Mais on peut noter un phénomène bien curieux qui se répéta plusieurs fois. Si on lui demande de lever la jambe de dessus le matelas, il le fait facilement la première fois; mais si l'on fait répéter le mouvement plusieurs fois, l'élévation est chaque fois plus faible, jusqu'à l'impossibilité d'exécuter le mouvement.

Si on le fait mettre sur un pied, la jambe gauche se fixe en extension, devient rigide comme si elle était en bois; le malade se lève d'une pièce, incline le bassin vers la droite, traîne la plante du pied, fait un pas très court et dirige la pointe du pied en dedans. La contracture de cette jambe est si gênante pendant la marche que malgré que la paralysie soit limitée à ce membre, le malade a gardé le lit constamment pendant tout le temps qu'il est resté à l'hôpital.

Pour en finir avec ce malade, je dirai que la sensibilité au contact, à la douleur, à la chaleur, au froid, la sensibilité spéciale des organes des sens sont normales. L'excitabilité électrique dans le membre paralysé est exagérée, les réflexes tendineux sont augmentés, et enfin la sensibilité musculaire est légèrement diminuée quant à la notion du poids.

Ce malade est resté à l'hôpital près d'un an, et il a été impossible de modifier la paralysie de la jambe gauche. Plusieurs fois de légères contractures sont survenues dans la jambe droite avec exagération des réflexes tendineux. Ce dernier symptôme s'est présenté aussi au bras gauche. Trois ou quatre fois le malade s'est plaint d'une sensation de pesanteur dans l'épaule gauche, semblable à ce symptôme initial que présenta le malade de la précédente observation.

Ces cinq observations démontrent jusqu'à l'évidence: 1° Que chez l'adulte la paralysie spastique peut se présenter consécutivement à des phénomènes cérébraux plus ou moins graves; 2° Qu'habituellement après la disparition des phénomènes cérébraux, la paralysie apparaît plus étendue, mais qu'avec le temps un ou plusieurs membres peuvent reprendre leur intégrité; 3° Que la parole peut rester plus ou moins compromise, mais qu'en beaucoup de cas les malades parlent normalement, et qu'enfin les malades peuvent rester monoplégiques, diplégiques, triplégiques ou paralysés des quatre membres, tout à fait semblables alors aux enfants dont les faisceaux pyramidaux ont subi un arrêt de développement.

On pourrait largement discuter le siège, la nature et la pathogénie de cette affection, mais je ne le ferai pas pour ne pas allonger ce travail, et parce que ces questions seront facilement résolues quand on connaîtra l'anatomie pathologique de cette entité morbide.

ON THE PROGNOSIS OF "RAILWAY SPINE."

By F. X. DERCUM, M. D., of Philadelphia, Pa.,

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A question invariably asked the expert in suits for damages in cases of railway injuries is, "Will this patient recover? and, if so, how long in your judgment will it be before recovery takes place?" I know of no question put to expert witnesses which is, as a rule, more difficult to answer, and regarding which there is often

such a variance of opinions. My experience does not accord with those who claim that the symptoms in a given case disappear with the award for damages. That buoyancy and exaltation sometimes follow a successful issue of the trial, and that the symptoms of mental depression, so frequently present, disappear for a time at least, can not be denied. However, if the case be watched, it will be found that long after the trial, when its excitement has passed away, the ordinary symptoms of the case persist. I have often been asked as to what treatment I would recommend for a given case, and have merely been able to answer in a general way that rest, tonics, freedom from care, would produce favorable results in time; that if the patient could be submitted to a prolonged rest-cure possibly recovery might be assured, or might take place more rapidly. A lack of opportunity to test the latter method of treatment has heretofore prevented me from giving a more definite answer. Recently, however, the opportunity presented itself. In order that there should be no question regarding the character of the case; in order that there should be no doubt or quibble regarding simulation, or improper motives of any kind, I selected for the experiment a case typical in character and in which there was no suit for damages. Before relating it in detail I will pass briefly over the method of diagnosis pursued by myself in cases of this kind, and which I have already published in a paper upon "The Back in Railway Spine."[1] The underlying principle of the method is to exclude as far as possible simulation or exaggeration of symptoms by the patient.

As is well known, the vast majority of these cases suffer from injuries to the trunk, more especially to the back. It is the back to which our attention is almost always called, even when there are injuries to the head or injuries to the limbs. With the patient standing or, if too weak, seated with the trunk exposed and the back turned toward the physician, the following tests are applied: After a rapid glance at the position in which the back is held, at the relative amount of curvature, at the differences in level of the two shoulders, at the presence or absence of muscular tremors, the following tests are performed: First, palpation: The hand being placed slightly upon the back the patient may or may not shrink. This symptom of itself counts for very little. It may indicate either the presence of a genuine hyperæsthesia or of a disposition to simulation. If hyperæsthesia be present, it is probable that we will find hysteroid symptoms as we proceed to study the case. The symptom by itself, however, as already stated, is of little value. The second test is by pressure. This I divide into superficial and deep pressure. My method of applying superficial pressure is as follows: I pass the finger tips, or the palmar aspect of the thumb, gently down over the spinal column, being careful to exert but a slight degree of pressure. As is well known, this test elicits in certain cases a flinching or other reaction as though pain were experienced, especially when we press over an area in the lower cervical or mid-dorsal region, over the dorso-lumbar juncture, the lumbar region itself, or over the end of the coccyx. The significance of this symptom I will not dwell upon now, but it is one which we all know is very commonly found in neurasthenia, especially in that form known as spinal irritation, and also in hysteria when the latter affection complicates neurasthenia. The next test is deep pressure. I now press the palmar aspect of the thumb with some degree of force upon various regions of the spine, and also over the adjacent muscles and various other portions of the back. If deep-seated soreness be present, as I have before pointed out, the patient is apt to react less suddenly than he does if simply a tender spot is touched by superficial pressure, or if there be general hyperæsthenia of the back. The soreness, if present, elicited by deep pressure is also more diffuse, and instead of being found directly over the spine of the vertebræ is apt to be found diffused for some little distance over one or both sides, or it may be found over the muscles in various other por-

[1] American Journal of the Medical Sciences for September, 1891.

tions of the back. Another test which I occasionally employ is the test by percussion. It is one of the tests that I employ when no reaction results from deep or superficial pressure, and is performed by striking with a small rubber hammer, the patient lying upon his face, a number of very rapid, though not hard, blows over the spines of the vertebræ, the idea being to elicit pain not by force of the blows, but by the faint but decided jarring produced. We now come to the test by motion. This also consists of two portions; first, the test by voluntary motion; and second, the test by passive motion. The patient is first directed to bend forward, his back being toward the observer. The manner in which the act is performed, the amount of the motion, the stage in the act of which the patient complains of pain, the area to which this pain is referred, and finally the occurrence of muscular spasm or rigidity should be noted. Next the patient is requested to flex the trunk to the right or to the left, and here again the character of the motion and the action of the muscles is studied. If no symptoms be elicited, or if they be of doubtful character, the operator may forcibly flex the trunk to the right or to the left, the patient not being warned beforehand of what the operator is about to do. As a rule this test is unnecessary. However, the following test I regard as very important in certain cases. This is the test by forcible rotation. An assistant, kneeling before the patient, should firmly grasp the hips, while the operator, seizing the shoulders, should gently but firmly rotate the upper half of the trunk. If there be deep-seated soreness the patient will at once give signs of suffering. As I have before pointed out, this method of searching for pain is a powerful one and is only required in exceptional instances. Its special application and significance I will not pause to point out. Next comes the test by transmitted shock. This I have also previously described. It may be practiced in various ways. The patient standing as erect as possible, the operator places both hands with fingers interlocked upon the head of the patient, and then by a sudden downward pull sends an impulse through the spine. The amount of force exerted must be guided by the reaction of the patient. The spine may be so very sore that the reaction to even a slight impulse is excessive and needless suffering caused; a gentle pull should at first be given, and if no response is elicited a more forcible one may be made. If it be desired to eliminate the cervical portion of the spine from the problem, the patient may be seated and the impulse be transmitted through the shoulders. A third method is to direct the patient, if standing, to raise himself upon the toes and then to let himself fall back heavily upon the heels. This method is less valuable than the others, for a man with a very sore back can absolutely not be made to execute this test properly. At most it should be used as a confirmation of pain doubtfully elicited by other means. I will not spend time in alluding to the various expedients, like the "double touch," for detecting malingering, nor will I recite the general methods pursued in studying the various subjective symptoms present in these cases.

The above tests that I have rehearsed apply of course to the physical condition of the back only, and help us in the formation of an opinion as to whether there is or is not an injury to the vertebral column, ligaments, the muscles, or other structures. It is not, of course, necessary to detail here the methods pursued in searching for actual lesions of the spinal contents. In my own experience lesions of the spinal contents in "railway spine" are rare, and, furthermore, they were not present in the case which I am about to detail. The case is as follows (its early history was in part reported in the paper already alluded to):

B. W., aged 42, married, carpenter and builder by trade, presented himself at the University Hospital December 5, 1890. On the 17th of June of the same year, while erecting a barn, he had been struck by a large rafter in the middle of the back, knocking him down and pinning him to the earth. He was unconscious for a few minutes and later he was sick at his stomach. Vomiting recurred repeatedly during the next four days, the vomit occasionally containing blood. During this time he was not confined to the house, but continued outside directing his

men at their work. He said, however, that he felt giddy and was afraid to climb to a height. His back, too, felt quite sore. About a week after the accident he began to be troubled with headache, while the giddiness became more and more marked. The soreness now spread all along his spine. His physician, who accompanied him to the hospital, said that pressure upon the spine now made him sick at the stomach and also caused his face to flush. He was obliged to remain indoors; he was unable to collect his thoughts; could not concentrate his attention upon anything; slept badly at night; was restless and delirious. He had also become very weak. On stripping the man it was noticed that he held his back very stiffly, and, further, that there was a marked tremor apparently of all the muscles of the back. Lightly placing the hand upon the back caused flinching. Superficial pressure was now made over the vertebral spines. It was found that the patient flinched slightly as the thumb passed over the upper and the mid-dorsal regions. Deep and persistent pressure was next made on either side of the spinal gutter over the muscles of the small of the back and adjacent regions. The patient now reacted in such a manner as to convince us that these muscles were exquisitely sore. Tested by motion, it was found that the forward flexion, in fact movement in any direction, was accompanied by excessive pain: and, further, by an objective symptom of great value, namely, excessive spasm of the muscles. In consequence the movements were limited in extent. On attempting forcible flexion, spasm and pain were both grossly exaggerated. Transmitted shock elicited pain in the upper and mid-dorsal regions. The knee jerks were excessively exaggerated. Ankle clonus was present on both sides. There was also paroxysmal contraction of the tibialis anticus, sweating so excessive that it saturated his clothing, and there was also occasional flushing of the face. In addition, the patient presented various subjective nervous and mental symptoms suggestive both of hysteria and of neurasthenia. I learned afterwards from his wife that in August of 1890, some two months after the accident, he had had a convulsion. He had been growing steadily worse and less and less able to attend to his business. The convulsions came on at night and was repeated for a number of nights consecutively. They are described by the wife as follows: "The convulsions usually came on at midnight, lasting until about 6 o'clock the next morning. They consisted of a series of paroxysms which followed each other at intervals of from five to ten minutes. The patient seemed to be entirely conscious during them. He would throw out his arms, throw back his head, roll up his eyes, and stiffen his limbs. Toward morning he would fall asleep and would wake up all right again. He finally grew so bad that he remained in bed continuously for about two and a half weeks, and then went to bed, off and on, until his visit to the University. He was delirious nearly every night during this time. He would have spasms, talk very much about the accident, and seemed to be constantly afraid of falling and of being hurt."

From the physical examination it was evident that the man had had a severe injury to the back. This doubtless consisted of a bruising and wrenching of the muscles and the muscular insertions. From the excessive pain present upon flexion and also upon transmitted shock it is very probable that the ligaments of the spinal column had also been strained. In addition he was excessively neurasthenic, and beyond a doubt the convulsions so ably described by his wife were hysterical in character. The case was thus a mixture of physical and subjective or psychic symptoms, and it may be looked upon as an exact counterpart of cases which every day appear as claimants for damages from railway accidents. It therefore suggested itself as an excellent one in which to test the resources of the rest cure. However, neither opportunity nor the patient's means permitted the carrying out of my suggestion at this time. The man went home and spent his time in and out of bed, improving a little now and then in proportion as he remained in bed, and presenting at the end of another year little or no change. He was now, January 12, 1892, admitted under my care to the wards of the Orthopedic Hospital and Infirmary for Nervous Disease (Dr. Weir-Mitchell having kindly granted me the privilege of one of his beds). His condition at that time was as follows: General fibrillary tremor of the muscles of the back and to some extent of the muscles of the arms. This tremor slightly increased on voluntary motion. There was also present excessive sweating, the surface of the trunk being decidedly wet. The back was exceedingly sensitive to pressure in the upper and mid-dorsal regions. The muscles to either side the spinal gutter were very sore. Forward flexion of the trunk provoked muscular spasm most marked in erector spinæ group. Lateral flexion produced a similar spasm. Transmitted shock elicited pain in the upper and mid-dorsal regions. All reflexes were exaggerated. Station fairly good; no bladder or bowel symptoms. In addition there was present tremor of the hands and of the tongue. The hands were livid, moist,

and cold. His weight at the time of the accident was 147 pounds; he now weighed 129 pounds. He was, further, exceedingly weak, nervous, and depressed, and suffered greatly from insomnia. He complained also of dreaming of the accident over and over again, and dreamed constantly of falling off of buildings. His wife now told us that in September of 1891 he had a return of his convulsions, and it took at times several men to hold him; that he was conscious as the attacks were coming on and as they were passing off; that he talked a great deal about having lost a piece from his forehead, asking each person who came to see him to try to find it, as his mind would never be right again until it was found; that he also cried a great deal, complained greatly of headache, and talked continuously about putting himself out of the way.

At the time of his admission to the Orthopedic Hospital no symptoms of delirium presented themselves. The man was placed in bed absolutely at rest and absolute seclusion was practiced as regards his relatives and friends. Systematic diet, in which milk played a large part, was now adopted and massage instituted. Later on the slowly interrupted faradic current was also used. Improvement was very slow at first, no change being perceptible for several weeks. However, little by little, a gain in weight was observed, and hand-in-hand with this also an improvement in the neurasthenic and hysterical symptoms. The back, however, remained painful to a very great degree. In the first few weeks following his admission he had several hysterical convulsions; later on these ceased altogether. His general condition continued steadily to improve, but the deep-seated pain and soreness in the back persisting, the treatment was prolonged week after week and month after month, in the hope of finally subduing it. At length it began to yield, but did not leave him entirely. However, on June 25, 1892, after over five and a half months of rest in bed, he was discharged almost but not entirely well. His weight had increased from 129 pounds to 157½ pounds. At the time of discharge his condition was briefly as follows: No fibrillary tremors present anywhere, no tremors of the arms or hands or any part of the body. Could flex the trunk, but it was still somewhat stiff and slight pain was still present. Any attempt at marked flexion still evoked slight spasm of the muscles. Did not sweat while standing still, but slight exertion or even mental excitement brought it on. His nervousness had practically all disappeared. He slept well and no longer dreamed at night. He said that he felt now as though he could work; in fact, that he felt now for the first time since the accident like "pitching in." This certainly suggested a marked return of energy. I impressed upon him, however, the importance of not doing a full amount of work at once, but of keeping up a partial rest cure at home. He did so, but notwithstanding had a return of a number of mild hystero-epileptic seizures this spring. However, a letter, dated June 22, 1893, tells me that he is well, with the exception of a slight soreness in his back.

The above case I believe to be extremely valuable from a medico-legal point of view, not only because of the absence of all elements of litigation, but because it throws considerable light upon the prognosis in this class of cases. It will be observed that before the patient was placed under systematic treatment he failed to improve. He remained practically in an unchanged condition, and it was not until systematic and an unusually prolonged course of "rest-cure" treatment was instituted that improvement finally took place. This man, further, had every possible motive to get well. His business and family suffered greatly by his absence. His worry from this source was very great. However, he now tells me that he is again actively at work at his occupation of builder. I should add, though, that none of the manual work is done by himself.

In previous papers[1] I have described cases without litigation, in which little or no improvement occurred even after the lapse of years. The only case in which I have had an opportunity of testing the effects of treatment was one in which the back symptoms were similar though the hysterical symptoms were absent. In this case, although rest in bed, massage, and even a plaster jacket were at various times instituted, and the treatment extended variously over two years, little or no improvement ensued.

[1] "Remarks on Spinal Injuries," Therapeutic Gazette, May 15, 1889. "The Back in Railway Spine," American Journal of Medical Sciences, September, 1891.

However, it must be admitted that it had not been possible at any time to institute a systematic course of rest cure. I am strongly inclined, however, to believe that in this instance it would have availed but little, and would not have influenced the chronic character of the case.[1] There are, of course, many cases in which tremor and spasm of the muscles of the back are not present or are concealed by the superficial fat. In these flexion, deep pressure, and transmitted shock, nevertheless, demonstrate the injury to the muscle insertions, ligaments, and other structures.

We now consider in how far are we assisted by the experience I have detailed in answering the question, "Will the claimant recover; and, if so, how long will it be before he recovers?" I have sometimes answered this question by saying frankly that I did not know. I was then asked by the court to use my best judgment and say how long it would take under the most favorable conditions for the patient to recover. Under the most favorable conditions generally implies a method of treatment which is not in vogue in general hospitals, which is rarely carried out as it should be in private practice, and which it is difficult to obtain except at special hospitals. This, I think, should be made clear in the answer of the expert when he answers that under the most favorable conditions, that is, by prolonged rest cure, the patient will markedly improve in about six months, but that complete recovery, if it takes place at all, will not ensue for several years. It must be borne in mind, further, that there are some cases of such great severity that probably no improvement will take place under any conditions, and also that there are others again very much milder in whom improvement takes place rapidly. Of course the answers must be adapted to each case.

JUDICIAL RECOGNITION OF IRRESPONSIBILITY IN ALCOHOLIC MENTAL DISEASE.

By NORMAN KERR, M. D., F. L. S.,

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There was a time, not very long ago, when the plea on behalf of an accused that he was "mad through drink" when he committed the crime with which he was charged would have had a curt reception from a judge. Nor could this be wondered at. In the belief that drunkards were but willful sinners, delighting to get drunk, voluntarily drinking only to become intoxicated and glorying in their shame, nearly everyone agreed. Judges are made of the same clay as is ordinary humankind, and it could not be expected that members of the legal profession would detect disease of the mind where even doctors saw only a moral vice. This state of things prevailed in every community as well as in Britain. In those "good old times" short and sharp was the shrift of the murderer, though he had previously been drunk for days or weeks or years, and had never had any intention of hurting anyone. The Grecian law was merciless in its dealing with this class of criminals, the convicted drunkard receiving, in Mitylene, under the law of Pittacus, a double punishment—one for the crime, another for the drunkenness. Probably because imbued with this tradition the great Sir Edward Coke declared that drunkenness aggravates a crime (Coke upon Littleton, 547 a). Since Coke's day there has gradually been effected a remarkable change in criminal practice. Hale in former times and Hawkins in our own day lay down that equal punishment follows a criminal act whether done in a state of sobriety or insobriety. (Hawkins, Pleas of the Crown, Chap. I, Section VI.)

[1] For a detailed report of this case reader is referred to the paper, "A Case of Railway Back," Journal of Nervous and Mental Diseases, 1892.

This drop from double to equal punishment was only one step forward in the improved and more humane as well as just advance in criminal jurisprudence. My highly esteemed friend, Mr. Clark Bell, has pointed out in that valuable magazine, the Medico-Legal Journal, and in the Proceedings of the (English) Society for the Study of Inebriety the striking development in this direction of American law and practice, a progress which has not been left far behind by the rulings of English judges and the pleadings by members of the British bar. Evidence is now freely received on the accused's state as to sobriety to determine the presence or absence, for example, of malice. In the case, tried before Lord Low at Glasgow in May, 1892, of a discharged army pensioner, who had with atrocious violence killed his female paramour, his lordship said that there had been no malice or deliberation, the intoxication having maddened the prisoner, which at once took the case out of the category of murder. A plea of guilty of culpable homicide was tendered and accepted, and the sentence of fifteen years' imprisonment passed. At the same circuit court a young girl was convicted of murdering her mother with a hatchet and other articles, both mother and daughter being drunk. A similar plea was allowed, Lord Young sentencing the drunken child-murderer to one year's imprisonment.

Among other advances has been the ruling of Mr. Justice Stephen (Regina *v.* Davis, Newcastle, April 27, 1881) that, though the immediate frenzy of intoxication does not absolve, any secondary disease producing mental unsoundness and resulting therefrom does. Accordingly we find that in many cases delirium tremens, characterized by Mr. Justice Stephen as a distinct and formed disease caused by drunkenness, has been held to be a valid plea for unaccountability. Let me refer just to a case or two. Lord Young (Regina *v.* Short, Glasgow high court, August, 1889) declined to send the case of a woman charged with killing her child by starvation and neglect while laboring under delirium tremens to the jury, on the ground that delirium tremens was a disease, and discharged the prisoner. Baron Pollock (Regina *v.* Mountain, Leeds, April, 1888) told the jury that heredity as affecting the capacity of a man to drink like other people around him, and inciting him while intoxicated to commit acts of violence, must be taken into account, as the last person to know his own weakness was the person himself. The prisoner was acquitted as insane. Chief Baron Palles (Regina *v.* Mary R. Galway, summer assizes, 1887) ruled that exhaustion through loss of sleep as a nurse, which in her enfeebled state caused alcohol to make her insane and was the cause of her killing the patient under the delusion that he was the devil, entitled her to acquittal. The prisoner was acquitted on the plea of insanity.

These eminent judges all thus recognized certain physically diseased mental states, affecting the power to drink with impunity as to the capacity to reason and know the nature of an act, as absolving from accountability. But Mr. Justice Day (Regina *v.* Baines, Lancaster, January, 1866) went still further when he laid down that "whatever the cause of the unconsciousness, a person not knowing the nature and quality of his acts is irresponsible for them."

In a recent case, that of a highly respected man with a history of paternal suicide after a drinking bout and a personal history of occasional epileptic fits, who had killed his daughter after a drinking paroxysm extending over four days, though he appeared to be sober at the time, the accused was acquitted as of unsound mind. The presiding judge, Mr. Justice Wright, held that though the immediate effect of intoxication had passed away there was evidently no criminal motive. The prisoner was on good terms with his daughter, and insanity seemed the only conceivable cause of the tragedy. This case was clearly a case of the post-paroxysmal mania of periodic inebriety. A still more recent case was that of a man tried before Lord Young at Glasgow on July 14, 1893, for shooting and killing another man, who happened to be in his room, while the former was laboring

under delusions due to alcohol. He had been drinking to excess for six months, but became sane after he had been kept from drink in prison for a week. He was acquitted on a successful plea of insanity, and ordered to be detained during Her Majesty's pleasure.

These with other cases show that the trend of modern criminal jurisprudence is in the direction of giving fair consideration to the mental state of accused inebriate persons, with a view to ascertaining how far they may have been responsible for their acts. Modern medical and pathological scientific investigation is day by day throwing a new and clearer light on many diseased brain conditions antecedent to, concurrent with, and consequent on inebriate indulgence of various kinds, gradually revealing that many intemperate criminals, who were formerly condemned as voluntarily guilty of deeds of violence and other breaches of the law, were really involuntary offenders. When skilled and reliable medical inquirers have come to a general conclusion as to these mind-clouding, consciousness-eclipsing brain states, the legal history of the past affords ample warrant for the hope that the bench and the bar will be found to be ready for the judicial recognition, in dealing with accused inebriates, of the latest discoveries of sound pathological and psychological research.

TREATMENT OF NERVOUS DISEASES IN SANITARIUMS.

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The purpose of this paper is not so much to advance new principles as to make clear and emphasize those already known, but not usually within the reach of the general or private practitioner. It is an established fact that chronic nervous diseases are the most difficult class to manage in private practice. I except in this statement, of course, mental diseases for which suitable institutions are now successfully established. If I am able to throw any new light on this complex subject, the object of this paper will be fully realized. It may be well at the very beginning of this discussion to say that in order to make clear some of the methods and combinations of treatment, as well as to explain some of the cases referred to hereafter, it will be necessary to make some personal references. Twenty years ago I began the study of nervous diseases under one of the most distinguished superintendents of the Northampton Asylum. The first ten years of my study and practice were chiefly given to brain and nervous diseases. A large majority of the cases that came under my care were women. In so many cases the real causes of the mental and nervous disturbances were found to be reflex that I was led to search deeply for the original as well as the exciting conditions, and to try many experiments for the relief of symptoms varying in their severity, all the way from mania and profound melancholia and malnutrition to insomnia, headache, and hysterical excitement. In the grosser pathological changes of the uterus, bladder, and liver the connections are easy to trace, but when the deviation from the normal condition is slight it requires a close study to detect the relaxation of reflex symptoms. From these studies and experiments, these failures and successes, I gradually evolved the idea that it would be wise to combine two dependent specialties, neurology and gynecology. I could get no light on the question of this duality of specialties, so I made an experimental trip to Europe. Convinced of its real and practical value, I gave up my work at the end of ten years and went abroad for two years of study, devoting my time to the development of the union of these two specialties, and since my return I have carried them along together with much satisfaction. I am free to admit, however, gentlemen, that I believe this system can be carried out much easier in a medical institution than outside in private practice.

Specialties can not be to highly esteemed and zealously encouraged. Specialties have elevated the practice of medicine from the routine and drudgery of empiricism up into the character and dignity of a science. While all this and much more is true, yet there is need for caution. Humanity is like the pendulum of a great clock; we swing to one extreme or the other, never stopping in the middle ground. I have often thought of this in watching and thinking of Gallileo's Great Bronze Lamp as it swings to and fro in the majestic duomo at Pisa. It was and has been and will be so in all professions. It has been so in medicine. When the literature and lines of investigation became too extensive for the individual mind and time to master, then, born of necessity, specialties blossomed into life. There is now danger of going to the other extreme. There is danger that specialties will become too special. In the last three decades specialties have been like trees grafted into the old stock, and had their root and vitality in the training of the general practitioner, who became specialists afterwards. In other words, they were grafted in the top. The danger is now that men want to be specialists without any general training or experience. There are men who rather pride themselves on not knowing anything outside of their specialty.

Gentlemen, would it seem immodest or presuming for me, before proceeding further to speak of the appliances, methods, and treatment of nervous diseases, to make a suggestion? I will venture. I would suggest that we have swung too far; that specialists are too much divorced and should be brought into more intimate and vital relations with each other. I would advise that specialists become partners or have adjacent offices, or, where practical, combine certain special lines of work, that they may examine cases and study symptoms and watch closely results and methods of treatment together. I would have the neurologist and gynecologist, the abdominal and general surgeon, the obstetrician and pediatrist, etc., side by side. I am satisfied from the experience born of a busy practice, covering a period of eighteen years in the treatment of nervous diseases and diseases of women, that men will be far more successful in proportion as they work together along these lines. A carefully prepared record of 4,000 cases bears witness to the truthfulness of this statement. A long list of cases come up to illustrate these facts; cases that had gone to the best nerve specialists, and had the most thorough and scientific treatment for their nerve troubles, and had not improved. Why? Because most of the difficulties were reflex. These same cases had gone to the oculist, and by him had been sent to the gynecologist. At his skillful hands they had been thoroughly treated for the troubles which he found, were they extra or intramural, para or periuterine, ovarian or tubal. But still the patients did not improve. Why? The treatment stirred up the already overwrought brain and hyperæsthetic nervous system, and the headaches, insomnia, irritability, and other symptoms grew worse. Finally these patients become discouraged and go home. What is the trouble? Were not all these men skillful? No one will question that fact; there are none better. Where, then, is the defect? I venture to assert from clinical experience that if these same men could have been combined in one, or could have treated these patients' nerves, eyes, and pelvic troubles conjointly, and each watched the effect of the other's treatment from day to day, instead of having them by installments, every one of them would have gone home well. I will only cite one case, as time is limited.

Mrs. B. J., aged 42, mother of four children, youngest 10 years. Marked neurasthenia with melancholia, insomnia, gastric irritation, and severe headaches; uterine hyperæmia and prolapsus. She had been skillfully treated by the best neurologists and gynecologists abroad and at home, and had been through the hands of the best oculists. She had been treated separately by some of our best men in New York for two years continuously, and all the symptoms had increased. The melancholia had deepened until it had assumed a suicidal type. At this stage she came under my care. It was an almost hopeless case, for she had tried nearly everything in the way of remedies and rest, and had had a good deal of sanitarium

treatment. I undertook the case without much prospect of success. At first I shared the responsibility with a lady physician, but finally took entire charge. After some weeks of a carefully modified course of systematic treatment, during which I followed closely all the details, she improved to a certain point, and seemed to hold only what she had gained. Then came the question of repairing a very slight laceration, which every one had thought of little or no consequence. I had noticed, however, that pressure on the cicatrix produced some of the nervous symptoms. I determined to try the experiment. I repaired the laceration, and, although it was impossible to keep her quiet or even in bed, the result was good. Everything seemed to aid in her improvement, and she entirely recovered.

In this paper I will endeavor to state clearly the reasons why we believe that nervous diseases can be more successfully treated in sanitariums than in private practice.

First. We all recognize without demonstration that one of the most valuable remedial measures in the management of nervous troubles is change of location, even though the surrounding conditions be not materially improved, and the value of this change is increased in proportion to the merits of the environments. In the city of Philadelphia Dr. William B. Atkinson has found that convalescent patients receive great benefit in being moved from one part of the city to another. This is often practicable when their means and circumstances do not permit of a more decided change. I have made it a practice for years when patients were recovering from a severe illness to change them as soon as it was safe to another part of the house with conditions as different as possible; also when a patient has been very ill in a room to change the location and surroundings. I have always found benefit follow these changes. There are always, in our widely diversified climate, resorts where we can send our patients and secure satisfactory climatic conditions, but very often many of the elements necessary to success are wanting.

Second. In these days of improvement and progress in every line there is no department of science and knowledge pertaining to health and happiness that has made more solid advances than that which we might call medical hygiene. Able bodies of distinguished men are devoting their best energies to the advancement of the foundation principles upon which the preservation as well as the restoration of health, nay, even of life itself, rests, and their combined labors are being richly rewarded. When our Surgeon-General, backed by our Federal Government, establishes a post-graduate school largely to advance the study of military hygiene; when such men as Mr. Ernest Hart can unfold with mathematical precision the hygienic principles that hold the secrets of controlling the dreaded ravages of cholera; when hygiene is made a special feature of a distinguished medical gathering like this, and a publishing house like the University of Pennsylvania Press embodies among its journals one on hygiene we can not fail to be deeply impressed with the importance of the subject. In this day a sanitarium to be worthy of the name must not only be situated in a healthful and bracing climate, surrounded by beautiful and varied scenery, possessing a variety of woodland shade and sunshine and a diversity of entertainment, but in addition it must possess that, without which no sanitarium or private hospital is worthy of patronage, a system of drainage that is as near perfect as human skill can make it. Elevated situation is an essential feature in the accomplishment of this end. We do not yet begin to know how much disease has its root back in the mysterious and secret laboratories of sewer gas, and to have a real sanitary institution it must be free from these noxious influences.

Third. A sanitarium that will command our confidence must not only be pleasant in its surroundings, bracing in its atmosphere, diversified in its entertainments, and free from any taint of sewage poison, but it must also have a good table. By a good table I mean a generous, wholesome, well-cooked dietary. This is an absolute essential to the successful treatment of most diseases, and especially is it true of nervous diseases. How many of us have been disappointed in the

results we hoped for in sending our patients away for improvement. The location, the air and climate, the surroundings, and even the sanitary arrangements generally may have been good, but with food poorly selected, badly cooked, and unwholesome in every way, we find our patients have lost instead of gained. I need not waste time in telling this able body of physicians how necessary in treating nervous diseases is the question of nourishment. Many cases would recover with pleasant and healthful surroundings and proper nourishment without much medication, while the same cases would not improve materially, however favorable the other conditions might be, if the table was unwholesome.

Fourth. A fully equipped sanitarium should have good mineral springs for both internal and external use when possible, the reasons for which will appear later in this paper.

Fifth. A remedial institution of this kind, in order to do its best, should not only have pure and mineral waters, but it must have a complete system of baths, which can be readily adapted by skilled assistants to any pathological conditions that may arise. It must also be furnished with apparatus for giving every variety of electrical currents; also it must be provided with skilled assistants and machinery for giving all the forms of manipulations and movements, active and passive.

Sixth. A sanitarium may have all the many advantages we have mentioned, and yet be successful only in the class of cases likely to be improved by change and general hygienic surroundings. To be complete it must have something more. Sanitariums and health or sanitary resorts are often confounded. A sanitarium, to be worthy of the name and to maintain a high standard and hold the confidence of the profession and the patronage of the laity, must have, in addition to these sanitary appliances, an able corps of medical men.

I have thus far briefly stated the chief distinguishing features of a scientific sanitarium. There are many less important points that will occur to you from your own experience. Having reviewed the equipments necessary to a remedial institution doing the best work in the treatment of nervous diseases, we will now consider the methods of treatment.

In this list of methods of treatment I unhesitatingly place, first of all, opportunity. The opportunity of having constant supervision of the patient can hardly be overestimated. No one can begin to realize the value of this privilege who has not tried both private and institution methods of treatment. It is valuable in diagnosis. This would imply that in this age of scientific knowledge there were mistakes made. Yes, that is true. It is true in all diseases, but particularly in functional nervous diseases. We do not yet know or agree on the exact nature of hysteria. Many cases of hysteria have been treated for organic disease, and many cases of organic disease have been treated for hysteria. I recall a case in point: Mrs. I. J. H., case diagnosed by several of our best nerve specialists as hysteria, and was treated for years as hysteria. She finally died, and the autopsy revealed organic brain disease. We need all the help we can get in many obscure nervous diseases, not only to diagnose the disease sufficiently to name it, but what is often far more important, to be able to study closely and note the differences in individuality and idiosyncrasy and treat it successfully. Again this access to the patient frequently enables the physician and attendants to study the treatment and its effects clearly, and decide many points which could be settled in no other way. This opportunity of frequent observation not only enables the physician to employ a great variety and degree of intensity of treatments, remedies, etc., with perfect safety, but also to note carefully the beneficial results, and the changes needed. It may be said that the trained nurse, to a certain extent, supplies this deficiency. A moment's reflection shows that both the means and the opportunity for observation in this latter instance are very limited.

Electricity, subtle, mysterious, powerful, and yet of great utility as a remedial agent, needs no champion. It speaks for itself in the thunder and lightning. It whispers in a million voices at once over the nation. It breathes its messages beneath the ocean. It purifies vast bodies of water for human consumption. It makes wholesale slaughter of germs, the enemies of our race. It lights our homes, runs our trains, propels our street cars, lifts our elevators, in short, vitalizes our entire lives. Why should it be less potent in restoring degenerated bodies? It is not. Electricity, galvanic, faradic, and static, in all the variety of currents has taken its place in the front rank of therapeutic measures. No nerve specialist, gynecologist, or even general practitioner can afford to ignore its merits, or sacrifice its therapeutic value. That it must be a potent factor in the treatment of nervous diseases in sanitariums will be taken for granted. There are, however, three serious difficulties in the general use of electricity. (1) Expensiveness of the apparatus. (2) The difficulty of obtaining thoroughly trained assistants; for I take it that there are few gentlemen here who have time to apply it to more than some of the most important cases in their practice. I have had any amount of trouble in training physicians, both male and female, in the use of electric batteries and the Apostoli method of treatment. It requires a certain amount of practical skill. I know a non-professional woman who has acquired great skill and success. (3) Constant supervision. Two apparently identical cases with the same disease, be it hysteria, eczema, locomotor ataxia, or neurasthenia, are not affected in the same way by the same bath or treatment. Neither is an individual affected in the same way on different days. Constant supervision is the price of success.

The general consensus of opinion is strongly in favor of all the various methods of improving nutrition, the circulation, and the tone of the nervous system by massage, Swedish movements, and the endless variety of machinery for exercising, toning, and improving the nutrition of the whole body. Here again we are met by the same difficulties; we find in the use of electro-therapy the need of expert assistants and vigilant supervision. For instance, these measures are very effectual in relieving rheumatism, circulatory defects, and nervous troubles; and yet they must be most carefully administered, for if overdone they are liable to cause nervous excitement, insomnia, or an acute attack of rheumatism. While it is not necessary in the employment of drugs to have this constant observation, yet it is of special benefit in the use of many of the newer and more powerful drugs. No one will dispute the fact that these same lines of argument on the value of constant observation apply to the question of the remedial benefits to be derived from rest treatment. Originating in Sweden, or perhaps in the far East in remote times, it has had many modifications, and experience has furnished abundant proof that each case should be studied by itself and treated on its own merits, adapting the amount of rest, seclusion, and exercise to the strength and condition of each patient rather than following some routine system.

All I have said about the great value of and the difficulties in the way of the scientific and successful employment of these special remedial measures applies with equal or even greater force when we come to the use of hydro-therapy. I have purposely left this until the last that I might consider it more fully. Though long known and its real merits understood by a few, yet the general appreciation of the value of hydro-therapy has only been realized in the past few years. It is like the operation known as "symphyseotomy," which was highly esteemed and practiced in Italy for twenty years before other nations began to appreciate its value. It is the popular operation now. Such classic works as Dr. Baruch's on hydro-therapy put it on a scientific basis. In hydro-therapeutics we have a mighty power for good or harm, and to be used successfully it requires (1) extensive and complete apparatus; (2) skilled assistants; (3) careful and continuous supervision.

This opportunity to note closely the effect on each individual case multiplies greatly the exceptions to many of the established rules of practice. I have recently had two cases of eczema extending over more or less of the body. The established rule is to avoid water in most cases of eczema, at least in the acute form. These seemed to me to be suitable cases for baths. I tried them cautiously with frequent modifications. Both cases entirely recovered. One of the cases was complicated with diabetes and the amount of sugar was 21 grains to the ounce. The ordinary remedies were used in connection with baths. This latter case had been for months under two of the best physicians in Canada, who had applied the same line of remedies and applications without success. The other case had been in New York. In both I recognized a distinctly nervous element. I have said that a thoroughly equipped sanitarium or private hospital should have, if possible, some good mineral springs to supply the water both for external and internal use. The positive value of spring waters of merit is becoming more apparent to the profession every year. The relation of hydro-therapy to disease, more particularly nervous diseases, is a subject still in its infancy. There should be pure spring water free from any possible source of contamination. There should be, when possible, water for internal purposes, that is alterative, laxative, and diuretic. There is also great advantage in having an alkaline water for bathing to neutralize the acidity so often found in connection with nervous diseases and acting as an exciting cause. While these waters for bathing are an important element in treatment, yet an equally vital one is the use of them internally. In the successful management of nervous diseases a free use of water is an essential remedy. I would emphasize this statement. England's distinguished therapeutist, T. Lander Brunton, has dignified water with the title of a "remedy." Savants in other countries have recognized its value as a remedy. There are also eminent men in America who appreciate the high position it occupies in the treatment of this class of diseases. I might mention the illustrious names of Meigs, Seguin, Ranney, Leuf, and Salisbury. These and others have referred to the value of water in the treatment of nervous diseases, but, like many great truths, important discoveries, or beneficial operations, the facts have not been generally accepted or applied. I am under the strongest conviction that this fundamental principle in the treatment of a large class of nervous as well as other diseases is not understood by the general profession, and not at all appreciated by the laity. You may ask what have the laity to do with this subject. I answer, the laity are the subjects and they do the drinking, and unless we can impress upon their minds clearly the rationale of its use and value they will not employ it faithfully. Water is such a common remedy they will follow it for a little while and then drop it. And here is one of the special advantages of treating these cases in sanitariums and private hospitals where the means are at hand, where the importance can be impressed upon the patient frequently, and where constant supervision will detect any marked variation from directions. When we remember that over 70 per cent of the human body is composed of water, it is easy to see that with a deficiency of this element health can not be maintained, and without this essential element in sufficient quantity any deviation from health can not be corrected. We might as well expect to run an engine without steam, a fire without fuel, or a water-wheel without a mill race, as to expect the skin, the glands, the kidneys, in short, the human economy, to go on performing its daily functions, and either maintaining health or restoring it when defective, without an abundant supply of pure water, the largest constituent of the body. It is an established fact that the better the nerves are coated, other things being equal, the less irritable and more natural is the whole nervous system. I have been making experiments in chronic nervous diseases with the object of testing the remedial value of the

internal use of water, either pure or medicinal, according to the associated conditions. These experiments include 400 carefully tabulated cases, aside from many more cases of which no complete record was kept. These experiments extend over a period of ten years. My plan was to take two sets of ten patients each, as nearly alike as possible, then to give each set of cases the most careful and approved care, making no change in the amount of water used by one set, but prescribing a marked increase in the amount of water drunk by the other set, and knowing that it was faithfully taken. The average increase in weight and general improvement in the set which used water freely was very much above that of the other set. These experiments were repeated so many times and with such care and close observation that there could be no question as to their scientific and intrinsic value. Definiteness and precision in prescribing and constant watchfulness in seeing that directions are carried out are essential to success. In the mystery of the value of water often lies the unexplained secret of the decided benefit frequently derived in nervous diseases, cystitis, and constipation from a sojourn at mineral springs, and during a course of rest treatment, in which large quantities of milk are employed. If you will describe to me a person who is nervous, who is irritable and out of sorts with the world generally, has dyspepsia and constipation, is sallow and has a bad taste in the mouth, has headache and does not sleep well, is troubled with bad dreams, often occupied in disposing of his relatives, has depression of spirits, is thin and has a hungry look, I will prove to you that such a man is a deficient water drinker. On the other hand, describe to me another man who is not nervous or irritable, who is in harmony with his environments, is good-natured and not a pessimist, has good digestion, does not have headache or constipation, who sleeps well and dreams little, and, if so, chiefly of angels and banquets, who is in good flesh and has the appearance of being well-fed; show me such a person and I can assure you, without further evidence, that he is a good water drinker.

I need not remind the members of this scientific body how often they have cases under their care which they know they could cure if they had the time and facilities for employing, under their own eye by trained assistants, more or less of the various means I have described in this paper, but it is quite impracticable in private practice. We all know what valuable aids to the efficacy of drugs, in the relief and cure of disease, are all these assistants: electro-therapy, hydro-therapy, massage manipulations, and mechanical appliances, rest and nutrition adapted to the needs of each individual case; but how are we to obtain them and, under what hygeinic conditions are they calculated to insure satisfactory results? It seems to me, as the result of many years' experience, that it can only be done by combining in one plant all the necessary means, as in a private hospital or sanitarium. If the length of this paper permitted, it would be gratifying to add many clinical reports in support of the principles herein set forth, but as it is not I will close with one more point, viz: The value of moral treatment in nervous diseases in an institution with the facilities described. It is a settled fact that it is difficult and often impossible to say where nervousness ends and mental aberration begins. Dr. Hammond puts the per cent at five out of six in ordinary life. These border cases are most successfully treated in these institutions. This moral treatment is essential to recovery. It is necessary to prevent nervous persons from introspection, to provide occupation and diversion, to avoid their dwelling on and discussing their troubles, and to prevent their forming incorrect and exaggerated notions about themselves, and the relative value of their symptoms and treatment. I am certain, gentlemen, that these patients can be kept better balanced, can be lifted out of their fancies, and make much more rapid and permanent improvement when under these combined influences of occupation, variety of treatment, moral discipline and support, and constant supervision in a cheerful, home-like institution. I

have frequently tested these principles in private practice and under this combined method, and I fully believe that the day is not far distant when the private practitioner, the specialist, and the sanitarium staffs will be mutually helpful each to the other.

ESTUDIO DE LAS CAUSAS, SÍNTOMAS Y TRATAMIENTO DE LA EPILEPSIA PARCIAL.

Por el Dr. ROQUE MACOUZET, de México.

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Voy á ocupar un momento la atención de las respetables personas que forman la sección 18 del Congreso Pan Americano en algunas consideraciones á propósito de las causas, síntomas y tratamiento de la epilepsia parcial, deducidas de mis observaciones de algunos años en el Hospital del Divino Salvador para mujeres dementes del cual soy médico. Me concreto únicamente al estudio de la epilepsia parcial ó Jacksoniana, pues no obstante que las opiniones de las autoridades en la neuropatología no están enteramente de acuerdo en comprender en este groupo tales y cuales casos, ya en el transcurso de esta memoria se verá cual es mi opinión personal á este respecto, haciendo esto mejor que dar una definición difícil de que sea buena en asuntos de medicina y más difícil aún cuando de este ramo se trata.

De la estadística que hemos formado podemos deducir que las causas más frecuentes de epilepsia Jacksoniana son los tumores cerebrales (gliomas, sarcomas neuróglicos ó angiocolíticos, psamomas, carcinomas, y mixomas). Viene después la sífilis (gomas, osteomas etc.); los reblandecimientos inflamatorios, la meningitis, los traumatismos craneanos, los abscesos y hemorragias corticales, los tumores meningeos y craneanos, los tubérculos, y la atrofia cerebral. Estos resultados los hemos obtenido tanto de las autopsias que hemos verificado, así como del estudio que varios médicos mexicanos han emprendido, en la capital y en los Estados, de los cadáveres de individuos que presentaban esta enfermedad.

SÍNTOMAS.

Para hacer un estudio metódico de los síntomas de la epilepsia Jacksoniana los dividirémos en dos grandes grupos: 1º, los de acceso, y 2º, los de los intervalos. Comenzarémos por estos últimos. Los síntomas que presenta el enfermo en los intervalos de los accesos son muy variados y los podemos clasificar en psíquicos sensitivos, motores, y tróficos.

Psíquicos.—Una de las cosas que más llaman la atención al hacer el estudio de esta clase de enfermos es la apatía intelectual. En casi todos los que hemos tenido oportunidad de observar, la memoria casi nula, al grado de olvidar algunos hasta su propio nombre, la atención excesivamente debilitada, lo mismo que la comprensión; otro tanto pudiéramos decir con respecto á las facultades afectivas. Este entorpecimiento intelectual se acentúa más después de los ataques. Generalmente son de carácter irascible. Algunas veces después del acceso les viene un sub-delirio tranquilo, aunque no es raro que les venga un verdadero acceso de manía aguda, como hemos observado en un caso. No son raras las alucinaciones de la vista y del oído; en algunos la aparición de figuras extravagantes, monstruos, fieras, etc., les anuncia el ataque, y en otros un ruído confuso y mal definido, un zumbido vago, una voz que balbucea frases incomprensibles en lengua extraña, un silbido. También hay alucinaciones del olfato, ya es el perfume de las flores, ya olores cáusticos ó pestilentes. También se suelen observar ilusiones.

La afasia en sus distintas formas se presenta á veces. Hemos observado un caso de sordera verbal representativa, en una Jacksoniana. A veces hay la ceguera verbal, pero esto es mucho más raro; otro tanto pudiéramos decir de la agrafia.

El vértigo es uno de los síntomas más constantes. Unas veces es el primero que se presenta y otras acompaña á los demás, ó aparece después que se hayan presentado.

Se observa en condiciones muy diferentes: ya se necesita que el enfermo haga movimientos muy fuertes y rápidos para que se produzca, ó bien basta el solo hecho de incorporarse en la cama, ponerse en pié, ó girar la cabeza; hay que notar que algunas veces este es el único síntoma de la enfermedad, sobre todo, el que se llama vértigo apoplético, en que el enfermo cae sin conocimiento, levantándose casi inmediatamente.

Sensitivos.—La cefalalgia es un síntoma tan frecuente como molesto. Es aguda, lancinante, persistiendo semanas enteras sin remisión; la impresión de la luz, los movimientos de la cabeza, el ruído, la inclinación del cuerpo, el simple esfuerzo de expiración, la exacerban y es tan fuerte, que á excepción de la uremia y de la meningitis, nunca se presenta con tal intensidad. Otras veces no es dolor propiamente dicho, sino una sensación de plenitud ó de vacío; ya les parece que traen en el interior del cráneo un cuerpo extraño que se les desaloja con los movimientos; ya que es un líquido viscoso que recorre lentamente toda la cavidad, ya al contrario muy fluido desalojándose entonces con rapidez; algunos se quejan de que les va á estallar la cabeza; tal es la sensación que experimentan.

No siempre está en relación el sitio del dolor con el de la lesión que lo produce; hay casos en que ocupa toda la cabeza; otras en sitio enteramente opuesto al que según los otros síntomas tiene la lesión, y no es raro que cambie de lugar. Sin embargo bien se comprende que haya casos en que coincida el lugar del tumor con el de la cefalalgia; así por ejemplo, un dolor tenazmente fijo en la región occipital, nos inclinaría á creer que el cerebelo fuera el sitio del padecimiento.

Por parte de la vista podemos señalar los moscas volantes, escotomas, congestiones, conjuntivitis muy tenaces, fusión purulenta del ojo, estrabismo, neuritis óptica, amaurosis lenta ó rápida en su producción, edema de la papila, hemorragia y atrofia de la misma. Ya se comprende cual deba ser el sitio de la lesión para que estos trastornos produzca, pero lo que no dejarémos pasar desapercibido es que estos son casi siempre bilaterales, no obstante que aquella generalmente sea unilateral. La explicación de esta paradoja es la siguiente: la decusación de los nervios ópticos no es completa en el quiasma, de manera que cada nervio tiene entre su orígen y el punto de entrecruzamiento filetes que van á dar á los ojos, de suerte que basta que la lesión interese al nervio en este trayecto, aún dejando intactos los tubérculos cuadrigéminos y aun el mismo quiasma, para que los síntomas oculares sean simétricos; ahora, si aquella está entre el quiasma y el ojo, entonces forzosamente que las perturbaciones tienen que ser unilaterales.

Los trastornos del oído consisten en debilitamiento, rara vez sordera completa; hay casos en que, al contrario, hay una hiperacusia muy pronunciada. Suelen venir dolores muy fuertes en el oído, ó bien zumbidos ú otras molestias que pueden traer consigo el vértigo de Menière.

El olfato y el gusto generalmente se conservan íntegros, pues son raros los casos que se señalan de anosmia y más raros aún los de desaparición del sentido del gusto. Otro tanto pudiéramos decir con respecto á su exageración. Suele haber alfalgesia de Pitres en el mismo lado. La sensibilidad general sufre algunas modificaciones; unas veces hay anestesia principalmente en el lado paralizado; otras, al contrario, hay una verdadera hiperestesia de manera que el enfermo no soporta ni el contacto de la ropa; la sensibilidad al calor y la eléctrica sufren también trastornos muy variados.

Motores.—Las parálisis de los miembros son muy frecuentes, pero muy rara vez completas, contrario á lo que pasa en las hemorragias, embolias, etc. Muy á menudo ocupan los miembros de un solo lado comenzando por un grupo muscular, para irse estableciendo así lentamente en todo el miembro y pasar al otro del mismo lado; pero no es raro que ataquen á todos los miembros; en este caso, una hemiplegia simple precede á la parálisis del otro lado. Esto se presenta ó bien cuando hay multiplicidad de tumores, por ejemplo, ó bien cuando habiendo uno solo está situado de tal manera (sobre los dos pedúnculos, sobre las regiones medias del mesocéfalo) que produzca la compresión de los haces quinesódicos de todos los miembros. Es excepcional el hecho de una lesión localizada de modo que produzca una paraplegia. Los esfínteres generalmente conservan su libre funcionamiento. Estas parálisis unas veces son persistentes y otras no, sino que ó desaparecen enteramente ó se atenúan de tal manera que quedan simples paresias. La razón de esta diferencia estriba en la causa que las origina. Unas parálisis se producen por la compresión que directamente ejerce un neoplasma, y estas natural y necesariamente tienen que ser constantes, y hay otras producidas por trastorno circulatorio, congestión, edema y aún flegmasia, variables como variable es la causa que las motiva.

La pérdida del equilibrio es otro síntoma que se presenta, haciéndose notar sobre todo cuando el enfermo se levanta rápidamente ó haciéndolo marchar con los ojos cerrados

La atetósis de Hammond se observa con bastante frecuencia, sobre todo en los casos en que es una paresia más que parálisis, ó que si existe esta no es constante y se ha observado que son los dedos por los que principia la convulsión en el ataque, los que ejecutan más esos movimientos vermiformes que caracterizan este síntoma

Las contracturas de los músculos de los miembros se presentan aunque muy tardíamente, excepto en el caso de epilepsia Jacksoniana, de orígen atrófico, pues en este caso son precoces y la Anatomia Patológica ha señalado degeneraciones secundarias de origen cortical en el pedúnculo, la protuberancia, el bulbo y el cordón medular antero-lateral. En estos casos existe la reaccion de degeneración

Las parálisis craneanas generalmente están del mismo lado de la lesión. En cuanto á la relación topográfica de estas y la de los miembros, es muy variable. Unas veces ocupan el mismo lado del cuerpo, otras son alternas ocupando lados contrarios, lo que sucede cuando el tumor obra sobre la porción periférica (células originales y cordón intracraneano) del nervio y no sobre su porción cerebral. En este caso y tomando como punto de partida los hemisferios cerebrales, el ojo está atacado después de su decusación, los haces motores de los miembros antes de su decusación y por consiguiente la parálisis debe residir por necesidad en dos puntos diferentes; del lado del tumor: para los nervios craneanos y del opuesto para los miembros. Si este es el caso, que más frecuentemente se observa, es por que los tumores generalmente están situados en la base ó regiones próximas, estando de esta manera en las mejores condiciones de ejercer una doble acción: directa sobre los nervios craneanos y cruzada sobre los de los miembros; por ejemplo, tumor que comprima el pedúnculo cerebral derecho, al nivel de la emergencia del motor ocular común: como este nervio no experimenta más decusación, y como los haces nerviosos de los miembros se entrecruzan antes de llegar á los pedúnculos, los contenidos en el derecho irán al lado izquierdo, de suerte que tendrémos la parálisis alterna de Gubler que es un buen síntoma para el diagnóstico de los tumores de la base. Ahora supongamos un tumor situado en el hemisferio derecho, por encima de los cuerpos estriados y de los tálamos ópticos; la parálisis del ojo residirá á la izquierda como la de los miembros, porque los nervios del tercer par están ya decusados á este nivel de tal manera que la porción hemisfé-

rica del nervio del ojo izquierdo ocupa el lado derecho; de suerte que podemos reasumir diciendo que las compresiones de los nervios craneanos dan lugar á parálisis directas, si es en la porción periférica, y cruzadas si es en la porción central. Los reflejos generalmente se conservan ó están exagerados. En la mayor parte de las enfermas que hemos estudiado, los hemos encontrado exagerados principalmente en el lado parético. En una de las enfermas cuya observación va al final de este insignificante trabajo, al buscarle el reflejo rotuliano provocamos convulsiones clónicas que le empezaron por el pié, propagándosele á la pierna y luego al muslo hasta donde quedaron limitadas, y en otra, al estarle percutiendo los tendones de la cara anterior del puño, observamos que le vino un verdadero ataque de convulsiones generalizadas con pérdida de conocimiento, siendo mucho más enérgicas las del lado que percutimos, que era el que estaba más entorpecido en sus movimientos y atrofiado.

Tróficos.—Las perturbaciones vasomotrices son muy frecuentes; algunas veces sienten los enfermos un frío glacial en los miembros entorpecidos ó paralizados y á la simple vista se notan muy pálidos; otras por el contrario, estan excesivamente rójos y el enfermo experimenta una sensación de calor ardiente; pero no es esto todo, sino que hay una verdadera atrofia de los miembros del lado enfermo; en las medidas que hemos practicado hemos encontrado una diferencia de volumen de algunos centímetros entre los miembros correspondientes. La secreción sudoral unas veces disminuida y otras aumentada; igual cosa podemos decir con respecto á la sebacea; hay casos en que cae con mucha facilidad el vello de la piel. Las uñas á veces se adelgazan notablemente en el lado enfermo. Ya se comprende que á consecuencia de la parálisis de algunos músculos, predomina la acción de los contrarios; de aquí la diferencia de actitud que toma la mano por ejemplo, pero en ésta generalmente persiste la acción de los flexores; de aquí que cuando son constantes estas parálisis la articulación del puño experimenta una sub-luxación hacia la cara dorsal, hecho que hemos podido comprobar en algunos de los casos que estudiamos. Otro tanto dirémos del miembro inferior, de donde resulta que el pié toma una actitud muy distinta según los músculos afectados (pied bot, varus, valgus, etc.) Por este hecho y por las paresias la claudicación es tan frecuente en estos enfermos.

El estado general es por lo común satisfactorio excepto cuando el vómito es tenáz y periódico, porque entonces se compromete la nutrición. Hay casos en que viene una gordura notable hasta la polisarcia. Con respecto al vómito tenemos que añadir que tiene todos los caracteres del vómito de orígen cerebral; no hay náuseas ni perturbaciones gástricas; es sin esfuerzo alguno y falta la hipersecreción salivar que le precede generalmente cuando es de otro orígen. La posición de la cabeza influye mucho sobre la aparición de este síntoma, de tal manera que basta muchas veces que el enfermo se coloque en el decúbito supino para que cese, reapareciendo cuando deja pronto esta actitud. Hay también descamaciones y gangrena superficiales, así como gangrena inminente vasomotriz, asfixia local de las extremidades de Reynaud.

Pasemos ahora á estudiar los síntomas del acceso própiamente dicho.

1º. Aura.—Puede ser sensitiva, motriz, y vaso-motriz. Muy frecuentemente el médico oye de los lábios del enfermo la descripción detallada y exacta de las sensaciones que experimenta antes del ataque, porque hasta estos momentos su inteligencia se conserva perfectamente. Del primer grupo, las de carácter anestésico y analgésico, son las que con más frecuencia se observan; es rara la hiperestesia; entre las vaso-motrices las sensaciones de frio ó de calor intensas, con acentuación del color de la piel ó palidez de la misma; el enfermo compara esto á la impresión que le causara si su mano fuese rápidamente sumergida en un baño helado ó hirviendo. Hay casos en que una abundante sudoración acompaña á estas sensaciones.

En cuanto á las motrices, ya es un temblor localizado en uno ó dos dedos; ya es la atetósis de Hammond, los dedos se doblan y se extienden alternativamente sin orden ninguno, exajerándose estos movimiento si el enfermo se obstina en dominárselos ó si fija mucho la atención en ellos: se les ha comparado á los movimientos que ejecuta un pulpo con sus palpas, ya es un solo dedo que se dobla y se extiende con movimientos rítmicos; ya se aplican los dedos de la mano unos contra otros de tal manera que á primera vista parecen sindáctilos; ya es el antebrazo que se dobla enérgicamente sobre el brazo, dirigiendo su cara interna hácia afuera; ya, como en una enferma cuya observación va al fin de este trabajo, se levanta todo el miembro como amenazante, ó ya en fin los ojos entran en nistagmus, fijándose hácia arriba y del lado paralítico, aunque sin estrabismo. Estas auras siempre tienen por caracter común el ser constantes; siempre se presentan con las mismas particularidades y el enfermo puede anunciar con matemática precisión el momento de su ataque. Su sitio y extensión están subordinados á los de la causa irritante.

2°. Ataque.—Según Rolland, en la mayor parte de los casos se encuentra una contractura inicial, seguida muy pronto de convulsiones clónicas más ó menos violentas, que quedan localizadas algunas veces al miembro en que principian, pero siendo mucho más común que se propaguen siguiendo un ciclo perfecto.

Efectivamente nuestras observaciones están enteramente de acuerdo con las ideas de Rolland, habiendo notado que cuando las convulsiones empiezan por el miembro superior, invaden en seguida la cara y después el inferior; si principian por el miembro inferior, ganan el superior y luego se extienden, y si empiezan por la cara, siguen el miembro superior y luego el inferior.

Los tipos más comunmente observados son el facial, el braquial, y el crural (este es el más raro).

Cuando habiendo empezado las convulsiones por un miembro se propagan, siempre predominan en intensidad las del miembro por donde empezaron. La duración del ataque es tanto menor cuanto más intensas y generalizadas son las convulsiones.

No es constante la pérdida del conocimiento. Durante las convulsiones la temperatura se conserva normal; el pulso y la respiración se aceleran.

En algunos enfermos la apatía intelectual se acentúa más después de los accesos. Uno de los enfermos que hemos observado se golpeaba fuertemente los carrillos después del acceso, y otro corría violentamente hasta agotar sus fuerzas. No todas las enfermas caen al suelo sino que, como el aura les da tiempo suficiente para acomodarse, hay muchas que se sientan para pasar su acceso en esta actitud. La duración media de este es de tres minutos.

TRATAMIENTO.

Cuando no se conocía la naturaleza de las lesiones, causa de la epilepsia Jacksoniana, se hacía uso para su tratamiento de los medios más variados, racionales unos, extravagantes otros, empíricos los más. Procurarémos exponer rápidamente los que más en boga han estado. Partiendo de una teoría falsa, antiguamente hacían abortar el acceso por medio de la ligadura enérgica del miembro por donde empezaban las convulsiones. De esta manera evitaban algunas veces que estas se generalizaran, pero una vez conseguido este objeto le quedaba al enfermo tal depresión, tal malestar, y tantos vértigos que muy pronto se oponía abiertamente á tal medio, prefiriendo las convulsiones francas.

Más tarde Bravais recomendó con entusiasmo la vesicación continua, de manera que se aplicaban al enfermo uno tras de otro, innumerables vegigatorios en todo el miembro que era el sitio de las primeras convulsiones. Este método fué muy detenidamente estudiado por Bentley y Todd, y últimamente, en 1861, por Brown-Séquard. Todos han convenido en que es incierto en sus resultados y

muy molesta su aplicación. Después estuvieron de moda las fuentes con cuentas de oro en el miembro enfermo, con idénticos resultados. Igual cosa pudiéramos decir de los sedales, moxas y cauterios que vinieron más tarde. También se recomendaban otras muchas sustancias al interior, como la belladona, el beleño, el óxido de zinc, el sulfato de cobre, el nitrato de plata, el cloruro de oro, el opio, el alcanfor y los bromuros; la hidroterapia, la electricidad, los imanes, etc.: pero en el estado actual de la ciencia pudiéramos sentar este principio general: "El tratamiento verdaderamente eficaz de la epilepsia Jacksoniana es la intervención quirúrgica." Con respecto á los accidentes sifilíticos, gomas cerebrales y otros, el tratamiento mixto está indicado; y aún cuando no se ha podido averiguar la naturaleza de la lesión, se debe hacer uso de este como piedra de toque. En el Congreso de Berlín de 1890, se expresó Horsley á este respecto de la siguiente manera: "Muchos clínicos admiten que el tratamiento mercurial y yodurado, resuelve siempre las gomas cerebrales y la paquimeningitis sifilítica. Ya Gowers, reconociendo que se obtiene con este tratamiento notable mejoría, ha protestado enérgicamente contra la opinión que acepta una regresión total. En cuanto á mí, estoy cierto que la paquimeningitis, cuya tendencia á reproducirse es tan grande aún después de la ablación, es únicamente mejorada y nunca curada por el tratamiento específico, y en cuanto á las gomas cerebrales debo decir, fundándome en la observación de varias autopsias, que muy poco debe esperarse de ese tratamiento, y que el único recurso para curarlas es la ablación por medio de la trepanación. Tengo éxitos. El mismo cirujano protesta contra la prolongación del tiempo en que se hace el tratamiento mixto como ensayo. "Opino que es muy sensible que no se marque un límite preciso á este ensayo, pues esta práctica nos obliga á operar algunas veces demasiado tarde. Según mi criterio el límite son seis semanas; si en este período no hay mejoría notable, no se debe vacilar y se debe practicar la trepanación exploradora." Como se ve, no se debe admitir en todos casos esta opinión absoluta en demasía de Horsley, y queda al buen tacto del clínico, y de la apreciación cuidadosa de los síntomas que presente el enfermo, seguir tal ó cual conducta.

Diremos pues, que los adelantos de la cirugía, debidos en gran parte á los trabajos interesantísimos de Demons, de Horsley, de Pitres, de Ferrier, de Championièr y de tantos otros, ayudados poderosamente en la ejecución por la práctica de la antisepsia, que hacen que la trepanación sea una operacion cuya mortalidad es relativamente muy reducida, han contribuido á aliviar á estos desgraciados enfermos, condenados á llevar una vida miserable, que paulatinamente se extinguiría en medio de los atroces sufrimientos de los ataques epilépticos.

En México, las operaciones que se han hecho para curar á estos enfermos han dado felices resultados.

EROTOPATHIA: MORBID EROTISM.

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Within the past few years the neurologist and the alienist have become familiar with so many strange morbid perversions and reversions of the erotic sentiments and sexual passion that they must be considered and classified in their relation to society, to morals, and to law. Science must severally classify these perversions of proper and natural human passion, as they may be found to be purely psychological moral perversities or to belong among the neuroses or the neuro-psychoses, and determine in them, respectively, the resistless or resistable involvement of the will. It must separate the psychoses of sexual aberration from the simple

neuroses of perverse sexual sensation and impulsion, without overwhelming impairment of volition, and these from simple moral vice, uninfluenced or unextenuated by neural disease. The sexually insane must be differentiated from such of these perverts as are not damaged in mind to the degree of insanity; a difficult task, yet one now imperatively demanded by psychiatry.

Westphal, Moll, Krafft-Ebing, and many others have presented instances of sexual perversion under the titles of "Urninge und Conträre Sexualempfindung," psychopathia-sexualis, homosexuality, etc., the *anima muliebris in corpore virili inclusa*, according to Ulrichs, himself a sexual pervert, and reasserted by Magnan, Kiernan, Gley, and Lydston.[1] Others have written upon frotteurs, sadists, necrophiliacs, anthropophagists (jack-the-rippers), sexual hermaphroditism, and other titles, all referring to the subject of perverted sexuality and morbid erotism.

Joseph Workman, of Toronto (American Journal of Insanity, Vol. XXVI, No. 1), in a paper read before the Association of Superintendents of American Hospitals for the Insane, June 6, 1879, has recognized among the insane, cases of the religious emotional type of insanity in whom exalted sexual feeling alternated with religious frenzy: and Schroeder Van der Kolk before this time called attention to the intimate relation discoverable between religious melancholia and an abnormal condition of the generative organs. We also have paranoiac, paretic, and lypemaniac forms and every possible intervening shade of mental aberration in morbid erotism, as well as simple erotic neuropathia without mental disease. This subject had not escaped the observation of Esquirol, who, describing erotic delirium, and referring to historic records, reminds us that the case of Heloise and Abelard presented an example of the association of erotomania with the prevailing religious sentiments of their time, and he thus draws the line between this morbid perversion of the passion of love and nymphomania and satyriasis. He also says:

> Erotomania is to nymphomania and satyriasis what the ardent affections of the heart, when chaste and honorable, are in comparison with frightful libertinism; while proposals the most obscene and actions the most shameful and humiliating betray both nymphomania and satyriasis.

The records of lunatic asylums give us many examples of the delusion of sexual reversion and subsidiary delusions in harmony with this dominant morbid idea.

Dr. C. B. Burr, of Pontiac, Mich. (Medical Standard, August, 1893), reported to the American Medico-Psychological Association the case of a paranoiac female who imagined herself to be a man, and announced that her title was Lord George. She assumed the stride of a man in walking and the attitude of one while sitting. After six years' confinement the patient was relieved of a tumor, and now again recognizes the fact that she is a woman. Dr. Burr has noticed that of late years delusions as to change of sex are becoming more frequent. Marriages between females also occur of late more frequently; the "husband" usually being a criminal in male attire, who leads a double life; honest with the "wife," but criminal with a gang at a different time of the year. These latter, which are simply immoral cases, are to be differentiated from the pathological, though they may be both, thus complicating our subject.

Respecting the evolution of normal and natural love we may remark, as Thompson and Geddes have stated, that in most of the emotions and in the simpler intellectual processes there is common ground between animals and man. This is especially true of the emotions associated with sex and reproduction. The love of mates has its root in physical sexual attractions, but has been greatly enhanced by psychical sympathies. The means of sexual attraction rise from the crude and physical to the subtle and psychical with growth of love. The intellectual and emotional differences between the sexes are correlated with the deep constitutional differences, and are the natural divergences of normal variations in the

[1] *Vide* Psychopathia-Sexualis.

organism. Male and female are complementary, and each in its own way. The love for offspring has grown as gradually as the love for mates. Even lactation and maternal care may be in part egoistic except in a few precociously tender animals. Genuine love for offspring is only emphatic in birds and mammals, where the reproductive sacrifice of the mother has also been greatly increased. The cuckoo illustrates the evolution of a criminal habit mainly due to constitutional conditions. Egoism and altruism have their roots in the primary or nutritive, and love in the reproductive activity. The divergent streams of emotion and activity have a common origin, subtly mingled at various turning points, and ought to blend more and more in one.[1] When we ascend from the lower animals up to man, and still further from the lowest human substratum of savage and semi-civilized man to the higher type of civilized and cultured manhood, we observe so refined and delicate a blending of passion and love that the two seem really separate and separable from each other, and in fact *are* so in the earlier and later years of human life, *i. e.*, before puberty and after the decline of virility in man or the passage of the climacteric in woman. Abelard, emasculated, jealously coërces Heloise into cloistered celibacy. These facts may have some bearing upon our subject. That function of love, jealousy, intimately allied in the lower animals and the lower order of man with the sexual life, has passed in process of the organic evolution of our species from an instinct of the lower organism to a place in the higher mind, regulated, restrained, influenced and influencing the sovereignty that resides in the intellectual centers of the cerebrum. Obeying the sovereign mind, its properly regulated indulgence gives health, vigor, and tranquillity; perverted by wrong volitions unrestrained, or by disease weakening the mind in its dominion, disquietude, diseases, disturbances, and tragedies follow. Morbid jealousy has helped to fill the world with woe. Its varieties[2] are: Jealousy of the senses (mere animal); moral or sentimental jealousy (heart jealousy); social or conjugal (which may or may not include the preceding).

Other facts of observation may aid us in solving problems of criminal responsibility in a class of cases germane to our subject, which we sometimes have to consider, viz, normal love. Normal love cherishes the loved one. Abnormal passion, solely selfish in desire and aspiration, considers not the welfare of its object so much as the wishes of self, but for the accomplishment of its end wounds body or mind and destroys both if necessary. Passion unrequited, vengefully breaks down all barriers. The mutual *odi et amo* of Catullus and Lesbia belong rather to lust than love. Love is tender, passion is violent. Love considers the loved one, passion regards only self and its instincts, impulses, and wishes.

We make no plea here in extenuation of genesic perversity, lust, rapine, pederasty, homoprostitution, etc. Disease does not ordinarily originate them. It only sometimes exceptionally excuses them. Salacity and sexual perversity may be solely immoral with no excuse in disease or pre-natal organic perversion. Sexual orgies the most revolting may coëxist with erotic disease on the part of some and without disease on the part of others who participate in them, as the London orgies of 1885, the Man-haters' dance in Berlin, and the floral festivals honoring the prostitute Flora of Ancient Rome, after Rome had, under the athlete and martial vigor of private and civic virtue, conquered the world and then had fallen a self-slain victim to her own unbridled luxury and lust. Normal love, too, has immoral perversities as abnormal love has its morbid perversions. Though there were Catos, who blushed at the shameless lasciviousness of these shocking floral games of the Roman arena played by nudity decorated with flowers, it must not be forgotten that the depraved populace of the amphitheater, neurotic and neuropathic alike, deliriously applauded this nude exhibition of men and women in lascivious attitude and public sexual commerce. Julius Cæsar was not, like his chaste wife,

[1] Evolution of Sex, p. 260.

[2] Paul Bourget, La Physiologie de l'Amour Moderne.

above suspicion, for does not Suetonius, the historian, say of the conqueror of all the Gauls, that he was "*omnium mulierum virum et omnium virorum mulierem*"? Morals and civilization have advanced beyond those of Rome. There are now no amphitheaters and no temples dedicated to Isis, no Gardens of Priapus (at least no public ones). *Venus Voluptia* and *Venus Salacia* have fled from the public courts. Neither religion nor law nor the general morals now countenance the open rendezvous of the lecherous and debauched, and no Catullus sings in soiled Latin verse of lascivious perversion, though we still have the lascivious contortions of the *jardin mabile* and certain obscene forms of the modern ballet and certain modern love novels, suggestive, without the open consummations, of the festival of Flora.

We can not enter into the motives of a Tiberius, who, under the limitless license of the imperial prerogative, commits acts of monstrosity unfit for print, or of a Nero emasculating and publicly wedding a Sporus, but we understand Hiliogabalus better. He loved the male slave who enslaved him and whom he made his wife and did not harm him. This was morbid erotism, and so appears the act of Nero above referred to; likewise the wedded union of Callistratus and Afer of Roman history. Certain we are that the lascivious libertinism and perverted sexual vices of antiquity, intermingled then, as now, in both neurotically sound and unsound organism, have not been obliterated from mankind. It has been passed along through the centuries. And we are confronted in this, as in all other studies of perverted functions of the nervous system and superimposed mind, with facts that belong alike to psychology and psychiatry, to neurology and neuriatry, namely, atavic descent and direct hereditary transmission. To solve aright the problems of morbid erotism and psychopathia-sexualis we shall have often to go back in a given case, if not to ancient history, at any rate to the ancestral records of character, so far at least as the grandparents, as we have to do in rightly determining other questions in psychiatry.

The trend and purpose of this paper is to further emphasize the fact that there is a neuro-psychical instability of the organism dominating individuals to the extent of developing resistless aberrations of thought and conduct connected with the genesic sense, now attested by abundant clinical observation in the field of practical psychiatry, aberrations entitled to be classed among the insanities. The recent example of Alice Mitchell, the sexual pervert of Memphis, Tenn., who murdered her fiancée, Freda Ward, whom she so ardently loved that she wished to flee with her, marry her, maintain her, and live with her as a man would live with his wife, wearing a mustache and the clothing of a man, murdered her because she feared that Freda would be lost to her love, intending to cut her own throat at the same time, because without her life was no longer worth living, brings this and kindred subjects once more forcibly to the minds of alienists and recalls the records of history and of the writers we have just quoted.

It is not strange that in these days of overstrain and overindulgence of all the emotions, the propensities, and the passions of the mind inherent tendencies to neuropathic instability should display themselves, under the heightened pressure of favoring environment, in peculiar forms of failure of inhibition and in exaltation and perversion of the erotic feelings and the sexual powers, as well as in the other familiar forms of neuropathic involution with which neurology and alienism are now so familiar. There is as certainly a morbid erotism, or propensity to excessively and perversely indulge the love passion, as there is an alcoholism or alcoholic disease dependent upon an organic and inherited neuropathic or self-acquired instability. This instability is deeply laid in the molecular movement of the nerve centers which underlie the expression, emotion, impulse, thought, and action, by which the individual—the ego—acts upon feelings, suggestions, and inclinations originating within him in a manner different from what would have

been normal to him or natural to civilized mankind in general. And these feelings arise from external impressions which would not excite the same or similar emotions, thoughts, or deeds in those who are normally constituted. This is the true morbid erotism of the neuropathic, and it is, of course, a nervous disease of erotic instability. Neurology and alienism must grapple with it, place it, and classify it among the psychoses or the neuroses. The older writers have long ago recognized and described it in its aggravated forms as erotomania. Every now and then it forces itself on public and professional attention, as in the case just mentioned and other similar historic instances, and in its other forms, as in nymphomania, satyriasis, and in the manustupros that tenant our penal institutions and the homes of the imbeciles and the hospitals for the insane. Besides the well-known illusional and delusional forms of perverted sexual feeling, among females the modern Madonnas who bear anew the immaculate Christ and the modern masculine insane who, in transformed madness, imagine themselves the sinless sons of God, there are the sexual hypochondriacs among both male and female neuropaths and the opposite mental states of psychical and physio-psychical neuropathic perversion. To the latter class belong many of the modern perambulating insane prophetesses of the Lord portending and proclaiming good or evil to the world according to the melancholic or paretic bias given to their distorted ideations by exalted or depressed cerebral activities: the under or over nourished state of morbidly acting ganglion cells in the cerebral cortex. Such, and many other varieties of perverted eroto-religious feeling and thought, are to be found in varying forms not here indicated both within and without the asylums. The paranoiacs are, as yet, mostly outside of these institutions. The public and the general profession, which knows little more of the delicate shades and intricate features of mental aberration than the people in general, have not yet sufficiently recognized it to secure the proper and timely sequestration of these pestilent cranks who are so pernicious to our personal weal and to the public welfare.

There are lypemaniacs and exalted erotics and those in whom shades of depression mingle with their exalted erotism and vice versa, and many intermediate grades of aberrant mental feeling, thought, and action. There are eroto-neuropaths and there are eroto-psycho-neuropaths, or more properly speaking, there are neuro-erotics who have reached the stage of sufficiently marked mental derangement to be classed as insane. There are many such. They are not markedly psycho-neuropathic in their erotism, but mainly unstably neuropathic. That is, though they have somewhat unstable nervous organisms in which a morbid erotism occupies and influences mind more than it ought, the mind in them has not yet become so weakened or disordered as that it sees not that the perverted erotic feeling is wrong, or sees not the propriety and necessity of resisting it. The mind does not succumb to, or become lost in, the morbid erotism. It is yet resistive, combative, and regulative. Still sanely balanced, though often assaulted by the morbid erotic feeling. The higher inhibitory centers of the supreme psychic area of the cerebrum still retain their physiological regulation and control. These erotics feel abnormally, but still act rightly. They yet belong to the domain of neurology, or neuriatry, if you will allow the coinage. Later, if their malady progresses, they may claim the attention of the alienist. They may pass into the domain of psychiatry. They are liable to become, at any time, under environment favoring the development of their disease, psychopathic, as well as neuropathic, and to need from without the restraint they can not exert from within upon themselves, over their erratic, perverse, and destructive erotic inclinations—the restraint and seclusion from the world which a properly organized asylum for the insane alone affords these unfortunates. The tendency of the age is to mitigate, if not to abolish, moral restraint. Freedom—physical, political, moral, mental—is the shibboleth of the people, and hordes of neuropaths, in whom impulses to moral degradation, entailed or acquired,

are unresisted, now come to the surface, that, in other ages, when laws were more rigid, were suppressed. The retrograde changes that have been going on in the morals of this country, as Esquirol said of France, "have produced more insanity than our political troubles." Neither did the revolution in France nor the rebellion in this country produce so much insanity as the sentiment of moral non-restraint or relaxation of self-control have done and are doing among those whose nervous organisms are inherently unstable. Sexual sensualism, to which those of neuropathic heredity are often congenitally predisposed, yielded to, brings on neuropathic excess and perversion of the genital instinct. When religion becomes simply a usage and a rite rather than a regulation of moral conduct; when the ambition of the age is to shine and scintillate rather than to grow in moral worth and in the grandness of self-control; when position and not self-equipoise is the purpose of the ambitious, and self-gratification of the pleasing propensities and passions and the indulgence of agreeable vices the aim of the many; when through pursuit of pleasure, without prudent restraints, unstable neurotics become still more unstable under the exhausting, irritating pressure of such adverse environment and pass from simple neuropaths, a little abnormal in their feelings, to fully-developed psycho-neuropaths, if love or the sexual passion be ascendant in the nature (and it is the dominant passion of mankind), the individual becomes startlingly deformed in mental feeling to the astonishment even of psychiatrists, accustomed as they are to seeing unique forms of diseased distortions of the mind. He or she develops into an erotic pervert or an erratic lover of his own sex—an "*urning*," a "*maedchen schmecker*," a sadist, fetichist, tribadist, etc.—an unnatural libidinous lover of a fellow-being organized like himself or herself, an erotopath (if you will accept this expression), and one of the momentous questions for psychiatry to now settle is when this morbid erotism, or erotopathy, is simply a neurosis, and when and where does it pass from simple neurosis into that degree of psychopathy which entitles it to be classified as insanity, uncontrollable, irresponsible insanity?

If we interrogate the records of this neurotic disease (*vide* Appendix, Workman's cases of alternating eroto-religious insanity and some cases from Krafft-Ebing), and from them endeavor to discover how much of grave psychosis and how much of simple neurosis we may find in them, we shall see by applying the accepted tests of alienism that the first five of Krafft-Ebing's cases epitomized in the Appendix show disease and perversion of sexual instinct, but they could not be classed as irresponsibly insane. The sixth case seems to have progressed to a mono-delusive stage as to her change of organism, with melancholia and suspicions of infidelity regarding the woman whom she loved.

We now invite your attention to the following, of which I have been personally cognizant:

A venerable and really good clergyman fell into disgrace from an act of exhibitionism, after the restraints of the higher intellectual centers over the lower and perverted instinctive impulsions had weakened the once well-trained volitional powers of the reverend old man and caused him to go into retirement and professional obscurity. A lawyer of my acquaintance, of ability, but of lowly heritage he never cared to disclose, acknowledged to perverted homosexual instincts and impulsions, and finally, under mortification and chagrin, and fear of disclosure of his perverted instincts, committed suicide. Cases like these are common.

In February of the past year (1892) a quiet, cultured, and gentlemanly appearing young man committed suicide by shooting himself at his room in a hotel in St. Louis. A combination of causes probably led to the despondency which ended in the rash act. Pecuniary embarrassment may have been one of them, but the chief cause, as elicited at the coroner's inquest, as testified by the male friend of whom he was enamored was that he had a morbid attachment for that friend. He wrote

long letters to him, teeming with endearing words. They had roomed together, but at the time of the tragedy they were rooming apart. This was his second attempt at suicide. At the time of his death he carried a locket about his neck containing the picture of the man he loved. He was an educated professional man, kind-hearted and of good address. The following letters, written in a neat hand shortly prior to and about the time of his death, serve to show the erotopathic condition of this young man's mind. They reveal the ardent feeling of the anxious, disappointed lover, much the same feeling as one madly in love might normally have for his heart's idol of the other sex, but never except unnaturally and abnormally for one's own sex, with homicidal and suicidal impulses of maddened desperation added:

My Dear Friend: Are you ill, angry, or merely careless? I looked for my usual Thursday's letter Saturday morning. It came not. I then felt sure you would write me on Sunday. I watched for the postman. No letter. He has been here this A. M., and still no letter. It makes me not only unhappy, but very anxious—unhappy since I am deprived of all that is left me to care for or look forward to; unhappy in the thought that I have displeased you: in suspense and anxiety lest some bodily ailment has seized that goodly frame and rendered you unable to communicate with me. If I do not hear from you in a day or so I shall be frantic and unfit for anything. I sent the stud on Thursday, which must have reached you Saturday, and not later than Monday, in which case I should have heard from you by this time.

My Dear Friend: I have just returned from the Cathedral, where Bishop Tuttle preached. My mind is not in a very receptive frame, so I can hardly tell anything he said. The pass was all a myth. The only pass I have is one into eternity. I even sold my dress suit and my old clothes to raise the funds to get here on. I came, intending to first kill you, then myself. I shall only make an end of my own miserable existence. My love for you has been my ruin. I can no more live a life apart from you than I can fly. The past month has been the test, and I can not do it. There is but one thing which could save me, and that is to pass the remainder of my life in your presence. I shall do that anyhow, for to die in your arms relieves death of half its terrors. I wish it would come to me naturally and you would have nothing to dishonor or grieve you. It is cruel in me to do this act, for it will blight your life. I should be more cruel to myself to try and live without you. You have done all but the one right and effective thing to save and make me, but it has all failed. I would gladly beg, steal, do anything—forego riches, forget friends, home, kindred, but for a life of blissful association with you. My office and outfit are all intact, and you can realize something on those things. Mr. C. H., X16 M. avenue, will see to the things. I appreciate all you did, and the effort and sacrifice you made for me. It was not in the right direction.

This letter to you is all I leave behind. I can not write anything to my parents. The blow will probably kill my mother. I shudder to think of it. We might have been happy together had it not been for W. The W., your brother's family, your other rich friends, your high social and business standing, your high ideas of morality, which you never filled—but 'tis too late; the end must come. I don't see why God did not let me die that Saturday night. I suppose there was some purpose waiting till you had made the outlay and sacrificed so much. You see, the end is all the same. Good-bye, dear L., I won't wish you happiness; you will never have that again and you will follow in my footsteps some time. Men of our natures and sins must have their punishment, and ours comes in a terrible shape. You are mine in the light of heaven, and no family ties can claim you from me in death. I pity you, but oh, to be free from all this agony of separation, suspense, doubt, is so welcome. May God deal with me according to my weakness. Keep my stud as long as you live; send my watch and ring to my mother. Let my last rites be attended by as little expense as possible. A pauper can not expect to repose in a metallic casket. I am going to bed, to sleep and gain nerve to face my fate. I have felt it must be, and since I have known you I knew you were to be the last straw. I have loved you better than you have ever been loved or will ever be loved again. Think kindly of that love sometimes. I am unworthy, but my love for you is worth a thought. Pray for my soul. Amen.

Much more than a sentiment of warm friendship for one's benefactor is breathed in these epistles of passion, desperation, and love, with its sequel of chagrin and suicide, without remorse for or full appreciation of the unnatural character of his

perverted love, though his Christian training had taught him to regard his unnatural passion as a sin.

The next record I have to make (from the proceedings of a recent public trial) is one in which this form of erotopathy developed into clearly defined insanity, with the murder of the loved object as its sequel. This girl was pronounced insane, on the witness stand, by Dr. John H. Callender, superintendent of the Nashville (Tenn.) Asylum; also by Dr. Michael Campbell, of the asylum at Knoxville, Tenn., and by Drs. F. L. Sim and B. F. Turner, of Memphis, and other physicians, including the family physician who attended the lady's mother through several attacks of puerperal insanity, at one of these confinements the lady under consideration having been born. Expert depositions sustaining the view of insanity in this case were taken of Dr. Charcot, Dr. Hammond, of Washington, and also that of the former family physician. The history of this case may serve to throw some light on the probable cause of the condition under consideration, for while there existed undoubted love and passion for one of her own sex, leading to jealousy, the victim of this form of sexual perversion was proven to have indulged in a very promiscuous kind of flirtation with the other sex as well, and the murdered girl, also infatuated with her murderer, was not always averse to the attention of men. How much may not mutual masturbation have had to do with the development of a morbid and perverse erotism in both? May not premature genital irritation, coupled with heredity, be a neurotic source of this baneful neuropathic perversion of the noble passion of love? Libidinousness, impurity, and lascivious sensuality are developed in this way, and by early bad companionship and salacious literature.

CASE OF ALICE MITCHELL AND INCIDENTALLY FREDA WARD.

Alice Mitchell and Freda Ward, two young women, loved each other, "not wisely, but too well." Their love culminated in a matrimonial engagement as between man and woman. The engagement ring was procured by Alice and placed on the finger of Freda. An elopement was mutually planned, and the clergyman to perform the ceremony was decided upon. Alice was to dress as a man, with a false mustache. "She knew she could marry Freda; she did not expect to have children," was her response to a physician's interrogatory (Dr. Turner's, after the murder) as to the impossibility of one woman marrying another, and "she could not be reasoned out of her idea that there was nothing preposterous in her marrying Freda." The elopement was prevented through intercepted letters and the vigilance of the relative with whom Alice was stopping on the very night it was to have taken place, while the steamer that was to have carried them away was at the landing (at Memphis, Tenn.). An enforced separation follows this discovery, some estrangement on the part of Freda, an attachment for a young man, which she later gives up and returns to Alice's love and embraces. They become again separated, have the usual lovers' misunderstanding, then jealousy succeeds on the part of Alice and its often sequel, vengeance. Alice goes in search of her recreant lover with her father's razor concealed about her person, finds her on the public roadside and remorselessly cuts her throat in the presence of the victim's sister and with her own sister in the buggy from which she leaps to do the murderous deed. She intended to kill herself, too, she says, but forgot it, because the murdered girl's sister belabored her with an umbrella. After the deed she went home, said she had cut Freda, and then began laughing and talking about other things. When the chief of police came to arrest her and asked how badly her victim was cut, she laughed and said, "Well, she bled mightily." She had had a whitlow and a thumb stall on her finger. At the time of the assault on Freda she had cut her own hand and blood was on the thumb stall. She put the thumb stall carefully away among her keepsakes, "because it contained the blood of both," she said. The next day, in a state of morbid mental exaltation, she read the account of her deed and of the death of her late beloved. She laughed over it and remarked upon it (so says the testimony) "as though she was not concerned in it."

And now we will let the unfortunate girl speak for herself as she testified, when summoned by the prosecution in the trial, the question being as to her mental condition. When placed on the witness stand in the court before which she was tried

as to her present mental status, this young lady deported herself and answered as follows to the questions of Attorney-General Peters:

Q. How long had you known Freda Ward (her victim)?—A. As long as I can remember.

The Attorney-General then asked about her visit to Golddust (a neighboring town) and she told in substance the facts of the tragedy. When asked if she met any young men at Golddust, she said she met two, Will. B. and Ashley R. Freda, she said, was engaged to R. Freda told her that Ashley had proposed to her (Freda) to run away and get married.

Q. Did you want her to marry Ashley?—A. No.
Q. Why not?—A. Because I wanted her myself. (Here witness broke down and wept briefly.)
Q. Did any words pass between you and Freda just before the killing?—A. No, sir; she only winked her right eye at me as she passed in front of the custom-house.
Q. Did that mean anything in particular?—A. Freda always told me that winking the right eye meant "I love you."
Q. Why did you follow Freda down the stone walk?—A. To cut her. (The girl's mouth shut down like a vise when she had spoken.)
Q. Why did you want to cut her?—A. Because I knew I couldn't have her, and I did not want anybody else to have her. I knew Harry Bilger loved Freda and I thought Ashley Roselle did, and I was afraid one of them would persuade her to marry him.

At first she intended to follow Freda down to the boat and kill her there, as it was a better place than the street. She could not explain why she determined to do the deed on the stone walk.

The witness, continuing, told her story of the killing, which coincided in every material point with the testimony of the preceding eyewitnesses. While everybody else in the court room, says the reporter of this trial, waited on her words with breathless interest, she settled herself comfortably in the chair and described the tragedy with infinite coolness.

As we carefully read this narrative and critically study all the facts, we discover the absence of ordinary motives which actuate the same murderer. She gratifies neither malice nor revenge nor cupidity, in the ordinary sense of these terms, in the doing of the desperate deed. The natural womanly timidity in the face of such a crime, of one of her station and rearing, does not influence or deter her from its perpetration. She does not contemplate it with horror. Neither the self-interests of her heart, her pocket, or her passion are satisfied in the act. She does not gloat over it as one of just revenge, or lament it as one of unjust violence toward the one of all others nearest to her heart, as Freda Ward undoubtedly was. In her weak and insane mind she thinks it an adequate justification and thoroughly good reason for destroying the woman she so intensely and morbidly loved, that she "loved her and might lose her." This is the reasoning of love merged into madness. After the deed she confesses to no anger, makes no special plea in justification of it, admits no mistreatment, says she "would like to see Freda now," "she was beautiful and attractive," and she "loved her more than anybody else," and does not discern the incongruity of such an unnatural love, the impropriety of such a damaging admission, nor realize, as a sane person would on trial for her life, the horrible nature of the crime she is charged with committing. She had deluded herself into the belief that Freda, her heart's idol, was lost to her. This was enough. Fresh from a spell of despairing, insane grief, of love which imagined itself hurt, and with the very razor she had bought for the unnatural purpose of developing on her upper lip the manly attribute of a mustache, that she might in man's apparel pass for a man, she coolly cuts the throat of her affianced of her own sex without sign of regret. Now, let her speak on, and note the words and manner of insanity in her utterances.

As I started down the hill I took the razor out of my pocket, and when I overtook her I cut her with the razor. I slashed her throat with the first stroke. She pulled away a little and said, "Oh, Alice!" or something like that. Then came a scream from Jo Ward or Christina Parnell, I don't know which. I let go of Freda and turned around and Jo Ward smashed me with an umbrella, saying, "You dirty dog, what are you doing to my sister?" I said, "I am doing what I came here to do, and I don't care if I hang for it." Jo raised the umbrella to strike me again and I cut her on the chin, I think. I did not want to hurt Jo, but when she called me that name it made me mad and I did not know what I was doing. I had intended to cut Freda's throat and then cut my own, but Jo bothered me and so I ran after Freda and cut her again. I did not want to butcher her up that way. All I wanted to do was to kill her. Somehow, I forgot to kill myself.

Q. (By General Peters.) Were you mad at Freda for any reason?—A. No.

Q. Had she mistreated you?—A. No, she had not.

Q. What person did you love better than anybody else?—A. Freda Ward.

Q. Didn't you love your relatives?—A. Yes, but not as well as I loved Freda.

Q. Why did you write to young men?—A. Because I did not have Freda to write to any more (and here another gush of tears came, but were quickly dried as before).

Q. Would you like to see Freda now?—A. Of course I would.

Q. Would you cut her throat again?—A. I don't know what I'd do.

Q. Why did you love Freda Ward?—A. I don't know.

Q. Did you think she was beautiful and attractive?—A. I did.

Q. What were you doing in your room at home?—A. Crying, mostly.

Q. Where did you write those letters?—A. In my buggy.

Q. What were you crying about so much in your room?—A. Because I could not have Freda with me.

Q. You loved her like a sister, didn't you?—A. More than that (and once more the witness' voice shook and tears sprung to her eyes).

Q. Did you take laudanum once?—A. Yes, sir.

Q. Why?—A. Because Freda told me she was going to marry Ashley Roselle, and that she loved another girl besides me.

Q. Did you arrange to marry Freda?—A. Yes, sir; Dr. Patterson was to marry us. If he refused, some justice of the peace, or somebody else would do it.

Q. Did you not know it would not be right for one girl to marry another?—A. Yes, but I was going to dress like a man and I thought nobody would find out that I was a girl. I intended to take Freda to St. Louis and work for her.

Witness said she liked Jo Ward till Jo went on the stand and told stories about her; still she felt sorry for Jo since Freda was dead.

Q. Do you remember telling Freda in a letter that you would send a certain kind of rose to her?—A. Yes, sir.

Q. What kind of a rose did you mean?—A. I don't know now.

Then Gen. Wright took the witness in hand. To him she said she was to go under the name of Alvin J. Ward and Freda was to be Mrs. Alvin J. Ward.

Q. (By General Wright.) Were you going to have a mustache?—A. Yes, sir. Freda wanted me to have one. I didn't care for mustaches myself.

Q. How were you going to get one?—A. By shaving.

She said she first got the razor on the 1st of November last. Freda had told her that she and Jo would be down from Golddust some time in November. She had come near cutting Freda's throat on the 7th of January, when the latter passed her in front of a photographer's on Hernando street. "But Lillie Johnson was with me," said the witness, with something like a sigh, "and I could not get the razor without her seeing me. I did not want Lil to know what I was going to do."

Referring to her proposition to Freda Ward that they should both commit suicide by taking laudanum, witness said:

I told Freda when she refused that if she would go to sleep I wouldn't take the stuff; I didn't intend to take it, anyway. I intended to put the laudanum in her mouth while she was sleeping so she would swallow it when she awoke. She would not take it, so I concluded to take it myself.

Q. (By Major Fleece, a member of the jury.) Do you still want to kill yourself?—A. I have wanted to die ever since Freda did (said the witness sadly).

Q. Do you intend to try to kill yourself again?—A. I don't know, but I want to die.

Q. That thumb stall with the blood on it, do you want to preserve it as a keepsake?—A. Yes, sir.

Q. Do you think it will do you good to look at it?—A. Yes, sir; I'm sure it will.

During the examination of the defendant her father and brother watched her with ill-suppressed emotion. Tears coursed down the old man's cheeks, and when it was all over he was totally unstrung. Indeed, there was but one person in the large assemblage who did not feel the relaxation of the severe tension of that half hour, and that was the unfortunate prisoner herself. She was very cool. She seated herself so as not to crumple her dress and immediately entered into conversation with those around her, talking in an animated way and laughing at times in a gay manner entirely out of harmony with her surroundings.

The case was submitted without argument by both prosecution and defense, and within eight hours thereafter, the jury having retired, brought in a verdict of "Not guilty, by reason of insanity," and recommended her commitment to the State Asylum for the Insane at Bolivar, Tenn., where she now is.

It will be noted in the above case that this girl's insanity was decided not alone on the very apparent fact of sexual perversion, though she was not averse to the society of young men, but had recklessly flirted with a number of them at Gold-dust while visiting the Ward girls there (testimony of Mrs. Volkman), and admitted corresponding with them, but also and mainly on her often-proven insane improprieties, the evidences of insanity in the crime itself, and the general conduct and speech of the fair defendant herself, so evidently out of harmony with the natural character and surroundings of a sane woman reared and environed as was this unfortunate girl. The public estimate of this case may be gleaned from the following reportorial record made at the time in public prints:

If any doubt of her mental unbalance had lingered in the minds of the jury it must have been effectually dispelled by the manner and testimony of this witness. She ascended the stand with a steady step and seated herself carefully, arranging her drapery so as to set off her plump figure to advantage, and faced the arbiters of her fate with the unflinching unconsciousness of a child. She spoke in an easy, conversational tone, enunciating every word distinctly, and giving ready answers to questions put to her. There was not the slightest suggestion of bravado, but rather the frankness of one fully prepared and one perfectly willing to impart information of no special interest to the informant. She lost her serene self-possession only when speaking of the mutual love that had existed between Freda Ward and herself. At these passages she would cry a little, then brace up and go ahead as before. At first it seemed that the State had made no mistake in placing her on the stand, for she talked for awhile in a perfectly rational manner, but when she began describing the tragedy itself, and proceeded to tell how she cut and slashed her victim, and all without the slightest trace of emotion, every hearer felt that it was no sane being who spoke.

The jury at once saw the insanity of motive and deed. And so it must be with the psychological expert in making up his judgment in these cases. Sexual perversion is not necessarily insanity, though it may be and often is a part of it. It may be the beginning and may lead to it, and it may be and is often the end of it. It is a perversion of the natural feeling, of the sexual sense or instinct. It is neuropathic perversion, dependent on neurotic degeneracy, involving the brain, and the psychopathic instability of insanity may follow the morbid perversion of feeling, passing into delusive speech and conduct based upon it, disharmonizing the individual with his normal nature and surroundings. Then he or she is insane. The perverted feeling then becomes more than a mere morbid perception. It passes into a wrong conception of the mind, which is delusion. It biases and controls speech and conduct so that the individual no longer adapts himself or herself to the restraints and demands of propriety, or harmonizes with healthy nature or natural and proper environment. The victim is then insane. His perverted feelings and impulsions dominate his mind and will. The perversion reaches the *ego*. The insane motive of this murder is apparent.

That sexual perversion is not necessarily mental disease may be proven not only by analysis of the numerous cases wherein the perverted feeling is accompanied with psychical resistance, shame and regret, but instances of the pervert practices

among whole tribes like those of the Pueblo Indians with their "mujerados," described by Hammond, and the "botes" and "burdachs" of the Montana and Washington Indians, as described by Dr. A. B. Holder, cited by Kiernan ('Responsibility in Sexual Perversion," in a paper before the Chicago Medical Society, March, 1892).

In the study of this subject mere perversities of the sexual act practiced from various rational but debased motives must not be confounded with organic perversity of impulse and conduct. The latter only is real disease; the other is only vice. The individuality of the person, the family and personal history, the violation of the proprieties, the existence of a diseased state of the brain and nervous system, the impulsion or deliberation, the motives and the question of disease are always to be studied in every question of perversity or perversion. A change of character may often be noted in true neuropathic perverts. Impulsions long fought against and resisted come finally to dominate the character, and the unfortunate individual becomes, like other insane persons, out of harmony with his surroundings and natural character, whereas the vicious pervert has learned his dirty tricks, has rational motives in their performance (filthy lucre often), and has ever been a willing victim. He neither loves nor dies for, nor kills, the object of his love. Depravity may make a business of vice and religion, as in the Temples of Venus and the Gardens of Phallus.

Hammond's description of the Zuni "mujerado" and the practices connected with this sexual pervert may be properly placed here:[1]

The Pueblo Indians are in the habit of selecting some one male from among those living in a village and rendering him sexually impotent, reserving him at the same time for pederastic purposes. This person is called a mujerado, a corruption probably of the Spanish word mujeriego, which signifies feminine or womanish. There is no such word in Spanish as mujerado; but if there were, it would, according to the construction of the language, mean "womaned," or "made like a woman." A mujerado is an essential person in the saturnalia or orgies in which these Indians, like the ancient Greeks, Egyptians, and other nations, indulge. He is the chief passive agent in the pederastic ceremonies, which form so important a part in the performance. * * * For the making of the mujerado one of the most virile men is selected, and the act of masturbation is performed upon him many times every day; at the same time he is made to ride almost continuously on horseback. From overexcitement comes abolition of the orgasm, the organs atrophy, the temperature changes, and he becomes assimilated with the female sex, perhaps at first with reluctance, but finally with entire complaisance and assent.

Sanity in a savage may be lunacy in a civilized being.

On this and kindred practices Kiernan remarks:

The influence of old religious practices long persists after the basis of these has disappeared. Such practices reappear at the seats of old Greco-Roman and Greek colonies in France, Germany, Italy, and elsewhere. The Zuni "mujerado" is hence not the evidence of either immorality or insanity it would be in an Anglo-Saxon race.

The Scythian *Enares* of Herodotus or the *anandrii* of Hippocrates, whose condition was so well explained by the skeptic Father of Physic, were sexual perverts whose impotency was caused by similar natural cause to that which weakened and destroyed the power of their legs. They were sexually weak and womanly, not from the retributive vengeance of Venus, whose temple they had pillaged at Ascalon, but from the long and unremitting marches in the saddle with their legs unstirruped. According to Hippocrates these Scythians wore breeches and passed the quarter part of their time on horseback with their limbs hanging without support, and "the disease attacked the rich and not the lower classes." The noble and powerful were its chief victims, "because they go much on horseback, while the poor do not." "These infirmities are widespread among the Scythians, who

[1] Journal of Nervous and Mental Diseases, 1882.

are not the most impotent of men." Hippocrates himself, however, drew a wrong conclusion respecting the influence of the cutting of the veins behind the ear in causing this sexual impotency.

The changes in character that take place in these perverts are the physiological results of lost virility, and the lost virility results from natural causes. The orgies and tribal rites associated with these sexual perverts were in some instances the result of delusive misconceptions as to the significance of the fact, but not the insane delusion of disease either on the part of the individual or tribe. The same is probably the true *raison d'être* for the conduct of the nomadic Nogays or Mongutays of Caucasus who, as they become old or sick, lose their beard and their sexual feeling, don the dress of women, and thereafter live apart from their own sex and in the society of women exclusively.

We have given the public opinion on the subject of Alice Mitchell's mental condition. The following summary by Dr. A. B. Holder, of Memphis, Tenn., gives the points on which the medical experts based their opinion that this erotic or sexual pervert was insane:[1] (1) Puerperal insanity of the mother before and at the birth of Alice (she was several months in an asylum) and insanity of uncles. (2) Her boyish tendencies in girlhood, indifference to young men's company, and general peculiarities, headache, etc.; her lack of mental development, seeming five years younger than her true age. (3) Her intense and peculiar affection for Freda Ward and her earnestness in the irrational idea that she could marry Freda. (4) Her murder of Freda, its cause, and manner. (5) Her words and manner when speaking of Freda and of the murder. These points are all presented in the history we have given of this remarkable case.

Per contra, we give an editorial extract from the New York Medical Record, in which the distinguished editor boldly cuts the Gordian neurotic knot, which alienists have so long been seeking to untie, with a temerity that settles the subject for him, perhaps, but not for the writer of this paper. It is a judicial finding, not an editorial fiat, that we now want. It is to unravel, not simply to summarily cut through with the scalpel of medical editorial dictum that this inquiry into these singular cases is made. All are peculiar! Some are insane! We would know who among the number, and when they are insane, and who simply are peculiar, yet responsible. To the alienist the question, as in moral insanity and other forms of affective mental aberration of differentiation of disease and depravity, often causes profound hesitation and sends him in search of the true data of alienism for sometimes even an uncertain decision. Dr. Shrady says:[2]

The young woman was afflicted with an affection which Science, with a big S, calls psychopathia sexualis, and pronounces the subject a victim of a perverted sexual instinct. The pervert in this case attached herself to a Sapphic friend, whom she killed one day in a fit of jealous fury. On trial, the defense of insanity was made. The medical experts were, we believe, unanimous in pronouncing the case one of a primary degenerative insanity, and the jury brought in a verdict of insanity.

We do not wish to contradict the combined testimony of so many alienists with reputations evidently very high in Memphis. Technically, perhaps, the girl was best considered insane; but we can not avoid believing that if this alleged lunatic had been treated for worms, leucorrhea, constipation, or some other of the frequent mechanical excitants of unhealthy sexual desire, or if she had been taken in hand early by those in authority and received a course of bread and water and, perhaps, some strong corporeal applications, she would not have become a Lesbian lover or a murderess. (Possibly, but this girl did become so and she was insane.)

There is no function easier to control or to corrupt than the sexual. While some sexual perverts are born so, the majority are not, but form their habits through gradual vicious indulgence. Nearly all are amenable to moral influences; that is to say, to rewards and punishments. The sexual pervert may be

[1] *Vide* Medical Fortnightly, August 15, 1892.

[2] New York Medical Record, August 13, 1892.

technically insane, but he or she is legally responsible, and should be so held. (Not if the motive of murder proves, as in this case, the insanity of the deed.)

Alienism does not say that all psychopathia sexualis is insanity. It modestly and cautiously inquires how much of insanity there may be in any given case of sexual aberration, and in determining the question applies the datum of alienism—the rule of departure from natural thought, feeling, or action, based upon disease perverting the brain and mind.

In Kiernan's contribution to our subject, to which we have already referred, another homicide resulting from this perverted passion is cited in the person of Miss D., a young lady of masculine taste, who, in 1878, "loved another young lady of Pocomoke City, Md. An attempt was made to break off the relationship, and an engagement was entered into with a young man, whereupon Miss D. shot her lover dead. She was tried and found guilty of 'manslaughter in heat of passion.'"

Parent-Duchatelet, in his work on Prostitution, gives at least one example of female love, jealousy, and bloody violence toward another female, somewhat like the case just cited, and Krausshold records the instance of another violent Lesbian lover whose passion passed into the insane delusion of being with child by the woman she loved, while Mantagazza gives several instances of actual marriage as man and wife between women.

Scattered through the literature, especially through that of legal medicine, and psychiatry are to be found instances of the most singular forms of this insanity of passion, but the true psychology of love and lust and the psycho-pathology and psychiatry of the sexual passion have yet to be written. Many inexplicable features of erotic perversion and psychopathia sexualis remain to the student of mental and moral science.

As we are about to conclude this paper, a case which may yet prove another *cas célèbre* is recorded in the public prints:

Two girls are arrested in the streets of a Western city (Indianapolis, June 27), whose erotopathia simulates that of Alice Mitchell and Freda Ward, without, thus far, the tragic ending of the latter. Their names are given as Delia Perkins and Ida Preston. They had run away from home together because of their love for each other. Delia had cut off her hair and offered it for sale in order that she might obtain money on which to help defray the joint expenses of herself and the loved Ida. When Delia's stepfather was summoned by the chief of police to come for his runaway daughter, she threatened to kill him, and when he came treated him coldly. To her stepfather's importunities to go back home with him she only finally agreed on promise of being permitted to see Ida whenever she should desire to, imprinting burning kisses upon the cheeks and lips of the paramour of her own sex on parting. These two devoted girls had been together almost constantly since their departure from home and they had not been in the company of gentlemen. The intense and active passion seemed to be on the part of Delia, Ida being reported as regarding the matter "as a huge joke." When Delia was returned home the following colloquy took place with her mother (now Mrs. Mendenhall):

MOTHER. You will not run away again, will you?

DELIA. Not if you let me go with Ida.

MOTHER. That I will not do.

DELIA. Then I will kill myself and you will be responsible.

MOTHER. Don't say that. We will try to make you happy and you must try to forget all about Ida. I can't understand why you do not forget this foolish fancy and fall in love with a man and marry him.

DELIA. I do not care for the best man that ever walked, and never will. Ida is the only one I ever loved and I will continue to love her until I die, and if we are not allowed to go together *I will kill myself and her, too.*

Miss Perkins told the reporter that she had not left home because she had been mistreated, but because of her love for Ida Preston. "My parents refused to let me go with Ida," said she, "and I decided to be with Ida, let the consequences be what they might."

Miss Preston stated that she had been met in the street by Miss Perkins; that the latter said she was tired of staying at home and said she was going to leave. "I didn't want to leave home," said Miss Preston, "but Delia told me she loved

me so dearly that if I did not consent to go with her she would kill herself and me, too. I like the girl, but don't believe I care as much for her as she does for me."

It is obvious that the limits of an essay forbid us to introduce the many special forms of sexual vice or disease or to engage in specific discussion. A diligent search for cases in the writings of Moreau, Tardieu, Marc, Caspar, Cullerre, Coffignon, Tarnowsky, and others mentioned in the text and Appendix, would suffice to show how futile any such attempt would be. However, as we are only here concerned in finding the correct principle of mensuration and analysis for these singular psychical freaks, a mere reference to a few typical cases suffices our purpose. A feature of most of the undoubtedly insane is the threat to kill the loved one or attempted murder, and threatened or attempted suicide. Having thus as delicately dealt with this indelicate subject as its nature would permit, a subject which the perversity of neuropathic organism has projected upon the field of scientific adjudication, I offer for your distinguished consideration the following propositions as legitimate conclusions from the facts set forth in this paper and in all other literature germane to our subject, in conclusion, we think the following are sustained or are sustainable from the present or more extensive study of this subject:

(1) Morbid erotism presents both normal and abnormal psychological aspects. It therefore presents a voluntary deviation from the ordinary and natural indulgence of the genesic instinct—the normal, but immoral psychology of the eroto-sexual propensity, and instinctive, inherent, organic, dominant, and often resistless involuntary perversions of this passion, the latter being the true abnormal and organically unnatural sexual perversion, the reverse, or contrary sexual instinct. This is the psychiatrical aspect of the subject, the one that most concerns us as alienists and neurologists.

(2) Love and the genesic sense are not one, as is shown in the antedating of love to the appearance of the sexual feeling, in the developmental period up to puberty and its survival beyond the menstrual climacteric in women. In the organic evolution of the individual, love antedates the birth and survives the decay of the sexual feeling, though it is intensified or diminished or otherwise modified or influenced by sexual states.

(3) The duty of the hour is to search out the complicating neurological and neuropathic factors, and the predetermining neuropathic conditions, the neurology and neuriatry, immediate and ancestral, of these unique morbid and unnatural eroto-genesic perversions; to weigh in conjunction the potentialities of physical or psychical environment, and determine as satisfactorily as we may, in the light of clinical and historic facts and physiological and pathological states, the true mental status of the eroto-sexual pervert with regard to:

(*a*) Responsibility to law with reference to specific perversions and ordinary crimes growing out of the eroto-genesic passion.

(*b*) Social status of sexual perverts.

(*c*) Substitutive acts, manustupration, body contact, incest, bestiality, etc., are not always to be classed as morbid perversions, but as purely immoral acts.

(*d*) In every inquiry the line should be drawn between morbid erotism, which is either an eroto-genesic perversion of pure Platonic love without genesiac concomitants and perverted lusts, or pure organic unrestrained, unregulated licentiousness, dissociated from love, or in which love is abeyant or insignificant and secondary.

(*e*) The conclusion of the matter is, that we are confronted in the study of this subject with conditions which are morbid, organically neuropathic and beyond the governing influence of volition, and, *per contra*, with other conditions which while they may in a certain sense be organic impulsions, are yet within the range of normal volitional control.

To the latter class ordinarly belong rape, incest, bestiality, and other unnatural crimes, the so-called "fetiches and manustuprates," while to the former belong the true morbid erotics, the urnings, the masochists, sadists, etc.

Medical science must study to determine for society and for the state what is restrainable and vicious, and what are the morbid and resistless organic impulsions of these *bizarre* eroto-sexual states, viz.: the true sexual insanities or psychoneuropathic perversions.

(4) This inquiry involves a study of hystero-erotic attachments and aversions, erotic trances, ecstasies, beatitudes, divine amours, immaculate conceptions, etc., as well as the true *conträre sexual empfindung* or psychopathia sexualis. It involves also certain morbid erotic perversions sometimes observed in epileptically insane females, such as vaginal mutilation with glass, pins, and needles inter vaginum, etc., epileptic and neurasthenic exhibitions, etc., during a psychical equivalent. We include all under erotopathia.

In every study of morbid erotism the distinction between love and lust should be sharply drawn, as between healthy erotism and perverted or debased sexual passion. This is necessary to a proper understanding of those historical and everyday recorded instances of pure but perverted Platonic affection and those oft-recurring and startling reversions of sexual love into murderous hate and passion, so often chronicled in the public press. The excesses of Heliogabulus and Hierocles, the Lesbian love, the *odi et amo* of Catullus, the Grecian youth defiling the statute of cupid in the temple of Delphi, and those horrible Artusian *libidos* of later date, whose morbid *vita sexualis* feeds, like the tiger's rage, on blood, require of us critical psychological analysis. These are to be compared and differentiated from the unrestrained but restrainable excesses of satyriacs and courtesans. There are Theodoras and male satyrs in human form in our day, as in the days of ancient Rome, whose excesses can not be extenuated on the charitable plea of disease. While science should cast the mantle of charity over morbid impulsions yielded to in resistless psychopathic states, it must draw the line between similar impulsions (depraved and but slightly, if at all, morbid) cultivated and gratified in normal psychical conditions. It must separate disease from depravity of mind, and herein lies the difficulty of our subject. The question of crime and insanity, often difficult to solve, devolves upon us as medico-jurists to determine from known and yet to be acquired psychologic and psychiatric data. The subject is primarily neither one of sentiment nor morals exclusively, but mainly one of psychiatry, to the study of which the data of alienism and psychology should be rigidly applied in all questions of medical, moral, and forensic inquiry.

Finally and fortunately, something, and in some instances much, may be done for these victims of *libido morbosus* by treatment. Sexual and psychical eroto-erethism may be subdued, the mind and feelings turned back into normal channels, the homo and hetero sexual changed into beings of natural erotic inclination, with normal impulsions and regulated restraint, by a suitable hygiene and therapy; medical, hypnotic, and in some cases surgical remedial treatment is hopeful of curative results in acquired sexual perversion, but only of repressive results in hereditary sexual perverts. Society, organized into government for the better security of person and property and personal and collective happiness, is specially concerned in the maintenance of chastity and morals. Personal and collective happiness depend upon this. The state, therefore, as Krafft-Ebing insists, can not be too careful as a protector of morality in the struggle against immorality; for sexual crimes are on the increase in our modern civilization, as shown by the statistics of Lombroso and Caspar, to which Krafft-Ebing refers, and by the startling records of the public press. Considerations of psychical sanitation demand alert attention to this subject from physicist, moralist, and jurist. The moral pestilence

is in our midst. Sodom and Gomorrah are revived and surpassed. Law, ignoring psychiatry and dealing violently with some flagrant forms of sexual vice, punishes the criminal as a wholly responsible being (but temporarily), and allows him to return and pollute society; whereas psychiatric science, knowing how deeply laid these sexual perversions may be in degenerate nerve element, which law can not correct, asks for their victim's perpetual sequestration from society and a radical asexualizing surgical procedure, such as the father of Heloise visited on Abelard. Inspired only by the spirit of vengeance, law protects society by punishing the criminal, while medicine would mercifully protect both society and the maimed victim of a sexually and mentally degenerate organism, whose acts are often as resistless as the mandates of a tyrant, because they spring from the despotically perverted cell life of a nervous system as badly endowed by pathological heritage as that of the average epileptic, and whose life is often equally as explosive. Nevertheless, as Krafft-Ebing truly states, the nature of these acts can never in themselves determine a decision as to whether they lie within the limits of mental pathology or mental physiology, and while most of these cases, to the honor of our humanity, fall within the scope of disease, we must here state again, in the language of the author just quoted, that "it devolves on psychiatry to show in any given case before the law that the perverse expression of the sexual feeling is founded in a pathological condition of the organism."

Appendix.

While it has not been deemed necessary for our purpose to go into further details of the varieties of sexual perversion, some of them being disgusting even to the cold vision of the scientific student of psychic perversion, yet the physician and the jurist can not ignore them any more than they can refuse to become familiar with the clinical features of foul disease or the details of revolting crime. Following are Workman's cases:

Case I.—A small and handsome woman, aged 39, of delicate structure, the mother of four children, was admitted into the asylum in 1860. Her insanity was of a very fervid religious type. She had escaped from home and was found after considerable search, with her younger child, in the church to which she belonged. She manifested well-marked hysterical aberration. I found her always too desirous of prolonging conversation and I took care to preserve a duly cool demeanor toward her. In four and a half months she had apparently regained mental integrity and was taken home by her husband. She continued well for nearly two years, when her insanity recurred in a very aggravated form. She evinced very warm, and I believe sincere, religious feeling. She was a constant and devout reader of the Scriptures and of select religious books, and so long as she continued able to attend she never missed divine service. The same tendency to prolonged and rather close conversation was again presented; she was the subject of intense hysteric seizures, in which the somatic movements clearly indicated that the uterine system was deeply implicated. At the end of four years this poor woman was released from her infirmities. The post-mortem examination gave revelation of serious morbid changes in the chest, abdomen, and pelvis, while the brain was found unaffected. The lungs contained numerous cheesy nodules, and showed old, firm costal adhesions. The abdomen contained about a gallon of greenish fluid. The peritoneum was thickened and coated with a green, cheesy deposit. The intestines were similarly coated and were glued together in an inextricable mass. Both ovaries were much enlarged and were transformed into cheesy matter. The uterus was covered with the general cheesy coating and its texture was much changed.

It might be difficult to decide in what part diseased action had had its commencement in this case. The uterus and ovaries may have been the primary seat or they may have been but simultaneous sharers in the general deterioration; but from their abnormal condition we may regard the salient manifestations of the insanity as having sprung. I was informed by her former medical attendant that he had found the erotic tendency a serious difficulty to deal with.

Case II.—Sometime previous to the preceding case another, of similar but more aggravated character came under my care. The patient was 44 years old and had borne eleven children. She was spoken of by her religious pastor in the highest terms of commendation. Her medical attendant designated her malady as nymphomania, and it may suffice for me to say here that the manifestations justified the designation. This woman's religious sentiment, notwithstanding her indomitable sexual tendency, was not obliterated. It was indeed painful to witness the incongruous coincidence. She died three years and a quarter after her admission.

The most remarkable facts exhibited by the post-mortem were the following: Hepatization to some extent of both lungs and numerous pleuritic adhesions. Several tubercles beneath the peritoneal coat of the ileum. An unusual fullness and rotundity were observed at the promontory of the sacrum. On removing the vessels and cellular tissue the enlargement was found to extend upward along the sides of the fifth, fourth, and third lumbar vertebræ. Fluctuation was quite perceptible. On opening the dilated membranes a quantity of creamy pus flowed out. The inter-vertebral cartilages appeared completely dissolved away and the bony structure was so softened that the scalpel easily penetrated it. The uterus was retroverted so fixedly, that when forced into the normal position it instantly, on being let go, retook its retroverted state.

Case III.—An interesting and pious young lady was very assiduously, if not skillfully, treated by her medical attendant, who had the misfortune to be very attractive. He diagnosed, perhaps correctly, uterine trouble, and being a specialist in that line of practice, he adopted the treatment which he considered indicated. It had, however, been necessary in order to arrive at exact knowledge of the state of the affected organ that a certain process of examination, not very compatible with virgin delicacy, should be instituted, and a repetition of this process was called for at each appliance of the topical remedy employed. All this must or should have been very irksome to the physician and very distressing to the patient, but custom reconciles us to many inconveniences. Had he better understood the peculiar susceptibility of women of fine-toned nervous temperament and religious emotionality, suffering under uterine disturbance, he would have made his visits as short and unfrequent as at all possible. Instead of so doing, he came often and remained long, cheering his patient with lively and kind conversation. She had religious anxieties, and doubtless he assumed the supplementary function of spiritual comforter. The actual state of affairs was, she was drifting into insanity, and he did not soon enough make the discovery. She had, despite the topical annoyances, fallen grievously in love with him and a severance had to take place. I was subsequently consulted. There was no doubt of her insanity, but her friends ascribed the malady to disappointed affection, and the unlucky uterine specialist now rests under their strong displeasure. I have since seen a case in which, from similar inadvertency, the same gentleman, in the management of a religious young lady, got into a similar predicament, but without the interposition of specular manipulation. A few more mistakes may bring him light.

Case IV.—The next case was that of a preacher, who, at the time of the development of his insanity, was very actively engaged in the work of a revival. He was newly married, and had for several weeks preached, in different places, three times daily.

He was brought to the asylum in a state of utter frenzy, and continued so for three weeks. The fact of sexual excitation was too patent to be overlooked, and it required not the information given me by his friends to satisfy me of the association which had subsisted between his religious fervor and excessive sexual indulgence. He made a good recovery and became a moderate man.

Complements of these cases in the females are doubtless well known to our gynecologic friends, and doubtless too well and too painfully so to some of the younger and less cautious and experienced wielders of the speculum. But gynecology, like psychiatry, lives and learns.

The following cases, abstracted from an article on "Perversion of the Sexual Instinct" (Report of Cases, by Prof. von Krafft-Ebing, which appears in the Alienist and Neurologist, Vol. IX. No. 4), will serve as sample records. His book, Psychopathia Sexualis, which has since been well translated by Dr. Chaddock, of St. Louis, has a far greater number and in far greater variety:

Case I.—Mr. X., merchant, 38 years old; residing at the time in America; disposition feminine; fond of music and literature; hates noise, disturbance, and obscenity. As a child he associated constantly with girls and played with dolls and toy

kitchens. Liked to dress in girl's clothing; when a student took no part in the gymnasium; delighted to help his mother with her household duties. At the age of 13 acquired a fondness for one of his own sex. At school he always had a lover and was horribly jealous of any girl or schoolmate toward whom his lover showed any preference. His delight was to kiss him. Had desire toward him, but propriety overcame it. Until he was 28 years of age was free from onanism, pederasty, or involuntary emissions. While still a young man he had a serious love affair with a sophomore, who returned his love with the enthusiastic friendship of a boy only, would kiss him and have erections with him. He raved over poetry and literature, and grieved when forced to be absent from him. The young ladies of the house where he lived had no such effect on him. He associated with them only in a friendly but entirely dispassionate manner.

Other Platonic love affairs with young men followed, but he realized his unnatural condition and was depressed over the knowledge of it. He never found in the society of beautiful women that invigoration of the mental powers which is commonly the case, but did find it among fascinating young men. He preferred to associate with married women or entirely innocent and disingenuous young ladies. Every attempt to draw him into the matrimonial net disgusted him. He sought the companionship of others like himself. One evening in the castle garden at X., where those constituted like himself were accustomed to seek and find each other, he met a man who powerfully excited his sexual feelings. * * * He would go often to the park and sought similar places in other cities. He formed an acquaintance with a young man who was eccentric, romantic, frivolous, and without means, who obtained complete control over him and held him as if he were his legal wife. He was obliged to take him into business. Scenes of jealousy followed. Repeated attempts at suicide were made by this new acquaintance. He suffered terribly by reason of the jealousy, tyranny, obstinacy, and brutality of his new acquaintance. When jealous he would be beaten and threatened with betrayal of his secret to the authorities. After this new-made lover had cost him 10,000 francs and a new attempt at extortion had failed, he was denounced to the police, arrested, and charged with having sexual relations with his accuser, who was equally guilty, and condemned to imprisonment. This destroyed his social position, brought his family to sorrow and shame, and the friends who had heretofore held him in high esteem now abandoned him with horror and disgust. * * * The manner of satisfying his sexual desires was not buggery, but a sort of onanism, produced by handling the genitals of another, whereby a healthy but not extremely exciting flow of semen would take place, after which he would feel refreshed and relieved. A bright, fun-loving young lady, who, as a woman, made no erotic impression on him, dressed herself in the uniform of an officer, with mustache, etc., and thus excited a sexual passion toward herself. A friend once advised him to marry and dress his wife in male attire. This pervert knew of a case in Geneva where an admirable attachment between two men like himself had existed for seven years. X. confesses that their "loves bear as fair and noble flowers, incite to as praiseworthy efforts as does the love of any man for the woman of his affections. There are the same sacrifices, the same joy in abnegation, even to the laying down of life, the same pain, the same sorrow and happiness as with men of ordinary natures." X. is described as of perfect physical build, with nothing remarkable as regards his sexual organs. His walk and voice are masculine.

Case II.—Count Y., 34 years of age, German, bachelor, consulted with Krafft-Ebing, in 1882, for nervous debility and abnormal sexual impulses. He was of muscular, masculine appearance, and, "with the exception of neuropathic eyes," was in no way outwardly remarkable. His mother was a woman of a highly organized, nervous, passionate nature, whose mother was extremely eccentric. His father was somewhat mentally deficient. Two sisters are apparently of normal intellectual qualities and of an entirely normal physical organization. The patient appears as an average man, somewhat overstrung, poetically inclined, and of fine feeling. As far back as he can remember he has had erections and sexual desires. In childhood he was attracted as much toward boys as girls, but toward the latter in an entirely Platonic manner, while toward the former he was sensually excited. He played soldier and preferred the company of boys. In his youth his sexual desires tended still more toward males, and he preferred to dance with boys. At 21 years of age the itching of a flea bite led to masturbation, which he practiced for several years and became highly nervous in consequence, but later abandoned the vice. At 22 he made an attempt at copulation, which disgusted him. He made no further attempts. A woman's breast seemed to him lacking in symmetry, and reminded him of the udder of a cow. Masturbation performed on him, however, by a woman aroused lively erections and sensual gratification. Afterwards his perverse sexual desires toward the other sex took a new turn, through voluptuous

dreams in which the woman would beat him and thus excite sexual desires. He hired a courtesan toward whom he felt no æsthetic or intellectual interest, who must stamp on him with her feet and strike him with a whip to arouse his passions to the highest degree. Then he would lick the woman's foot. The foot of a woman or of a boy is the only thing that sexually excited him. With that his sexual excitement would reach its height, and an emission would take place, followed by a sense of degradation, sexual satisfaction, and disgust. His genuine sexual feeling, however, attracts him to those of his own sex. This patient does not feel unhappy in his perverted sexual instincts, but deplores the fact that social customs deny him the highest sexual enjoyment. His practices with women are but unsatisfactory makeshifts. His erotic dreams are of intercourse with boys and sometimes relate to beatings at the hands of women. The patient is hypospadiacal. His nervous affections are the common form of cerebral and spinal neurasthenia with agoraphobia, fearfulness, headache, spinal irritation with hypochondriacal paroxysms. This sexual pervert married a lady who attracted him through her qualities of mind and who on account of female troubles and probably weakened sexual instincts made no demand on his sexual qualities. Patient married, as he says, "to satisfy society," the mental qualities of the lady being congenial, but he wishes for a childless marriage that his pathological peculiarities may die with him and not be a curse upon future generations.

Case III.—Mr. Z., 36 years of age, bachelor, of high social standing; father was neuropathic and eccentric; mother nervous; brother showed signs of sexual perversion. Of ten brothers and sisters one sister is psychologically abnormal, two others dislike men and love women. As a child, was weak-limbed and of a nervous organization, fond of feminine work and play, no fondness for boys' games or hunting, and was laughed at and scolded for his feminine ways. At the institute he acquired the practice of onanism. At the age of 13 he formed a burning attachment for an elderly officer. From that time on he only cared for those of his own sex and then not for the young, but for those of riper years and robust form. Such men fascinated him; "women were no more to him than porcelain pictures." He "could see no beauty save in the male form and thought the bosoms and wide hips of women were unæsthetic and ungainly." At the galleries it was only male statues that pleased him; at the circus, male performers. At 16 he became desirous of looking at male genitals. After he was grown up his comrades took him to a brothel. He could not perform the act of coition from sheer disgust. Manustupration by woman produced ejaculation accompanied by sexual gratification. He felt immeasurably unhappy and melancholic when his family tried to draw him into a marriage, and felt as relieved from imprisonment when the lady married another. He only finds happiness by association with men. For many years he had suffered from neurasthenia, with severe headache, sleeplessness, genital irritation, hypochondriacal symptoms, etc., all of which he ascribed to the fact that he had been unable to satisfy his sexual desires, and to onanism, which he had practiced as a substitute. Sexual satisfaction was obtained by kisses and embraces with a man, especially if the man lay on him. Every ten or twelve days he would experience these desires, and if he could not satisfy them he became nervous and irritable and had all sorts of nervous derangements. He felt in fact like a woman in the sexual act. His highest idea of pleasure was passive pederasty, and in Italy he once attempted it, but disgust prevented him from completing it; it reminded him too much of coition. His highest happiness would be a sort of marriage with a beloved being of the male sex. The few erotic dreams which he experienced had for their subject men. He was unhappy, not only because of his abnormal sexual position and the resultant nervous disorder, but because he feared insanity as a result of his troubles. The constant fear that his secret will be discovered and his social position thereby destroyed makes his whole life miserable. He dare not be a father lest he should bequeath to his children his own abnormal nature. Patient is an intellectual-appearing man, of strong masculine build, with heavy beard, showing no abnormal appearance and having nothing feminine about him, either in his manner or his dress. An expert would remark the extremely neuropathic eye. The nose is unusually large. The upper teeth are somewhat decayed. The skull measures 53 centimeters. The pelvis and genitals are normal.

Case IV.—Herr von Z., a Pole, age 51, neurasthenic since 17. Mother was not mentally normal. She hated her children and loved her dogs. At cadet school he acquired the practice of onanism. He developed normally, sexually and otherwise; enjoyed sexual intercourse with women until he was 25 years of age; married a congenial lady; acquired at 26 serious nervous complaints, and developed a fondness for those of his own sex. He was compromised in a treasonable plot and sentenced to five years in Siberia. There his condition was aggravated as the result of continued masturbation. When released at the age of 35 he was suffering from

cerebral and spinal asthenia, dyspepsia, hypochondria, trembling, morbid anxiety, spinal irritation, nocturnal emissions, etc. He then sought relief at the watering places and medicinal springs, but failed to obtain it. His abnormal sexual feelings were in no way changed. He lived mostly separate from his wife, for whose mental qualities he had a high regard, but toward whom, as a woman, he was as indifferent as toward all other women. His otherwise pronounced fondness for those of his own sex was entirely Platonic. He was satisfied with their friendship and with hearty kisses and embraces. Whatever lascivious dreams he had, had those of his own sex for their subjects. While awake, too, the sight of well-formed handsome men would cause erections and ejaculations, while the most beautiful women had no effect upon him. At times of great excitement he would have erections at the sight of even male statues. At the circus or in the ballet it was only the men who interested him. He considered his perverted taste as a physical malady, without being rendered unhappy by it. A course of common faradization restored this man to his normal sexual condition.

Case V.—Herr Y. Z., 29 years old, a real estate owner in Russian Poland. Grandfather had melancholia and died suddenly at 47; mother neuropathic, of a neuropathic family; brother committed suicide; a cousin showed perverted sexual instincts. For generations the family has intermarried. The patient has had scrofula and headache, and a cerebral injury. At 13 he began onanism. A few years later he acquired severe cerebro-spinal neurasthenia, with irritable genital weakness and frequent pollutions. His nervous troubles have increased and hypochondriacal symptoms have appeared, with delusions of persecution. Has since childhood had a Platonic fondness toward males, and since the age of 9 years had frequently been in love with them. At the age of 20 he began to feel a longing for sexual connection with men; old men of about sixty. The female sex had no attractions for him; never realized any passion for sexual commerce with them. In order to alleviate the effects of self-pollution, he had at times attempted, under medical advice, to hold sexual intercourse, but he found himself impotent. His pleasure was only in intimacy with men. In his weak sexual condition a kiss or an embrace was sufficient to produce an erection and ejaculation; later he had become so excitable that the sympathetic pressure of a man's hand was followed by an emission. He found himself, therefore, compelled to withdraw from the society of men. At Gratz he formed a Platonic attachment for a student and a bath attendant. At Venice he fell in love with a 19-year-old youth and made him his mistress. Their sexual intimacy consisted in kisses, embraces, and the handling of the other's genitals. He never went as far as pederasty. He formed other similar attachments, caused a scandal in the hotel, and was obliged to leave Italy. So long as he could satisfy his sexual desires the neurasthenic symptoms disappeared entirely and the delusions regarding persecutions remained dormant. When he returned home, where he could not satisfy his sexual desires, there was a recurrence of neurasthenia and delusions, which finally obliged his removal to an insane asylum. Herr Z. is of a muscular and wholly masculine appearance. The left testicle is not descended. Otherwise the genitals are well developed; hair and beard abundant; voice manly; demeanor shy, but in no way offensive.

Case VI.—Miss X., 38 years old; had severe spinal irritation and chronic insomnia. Her mother was of a nervous organization; the rest of the family apparently healthy. Her sufferings dated from a fall upon her back received in 1872, which caused the patient a severe shock. In connection therewith there developed neurasthenic and hysterical symptoms, with severe spinal irritations and insomnia. Episodically there was hysterical paraplegia of eight months' duration, and instances of hysterical hallucinatory delirium with convulsions. In addition there were symptoms of morphinism. The patient attracted attention by her clothing features, man's hat, short hair, spectacles, gentleman's cravat, and a sort of coat of male cut covering her woman's dress. She had coarse male features, a rough and very deep voice, and, with the exception of the bosom of a female and contour of the pelvis, looked more like a man in woman's clothing than like a woman. During all the time I had her under observation there were no signs of eroticism. As a child she had fondness for horses and masculine pastimes, but never took any interest in feminine occupations. She later developed a taste for literature, and sought to fit herself for a teacher. She never enjoyed dancing, and the ballet had no interest for her. Her highest enjoyment was to go to the circus. Up to the time of her sickness, in 1872, she had no particular fondness for persons of either sex. After this there developed in her an attachment toward women, especially young women. She was never passionately aroused in her intimacy with them, but her friendship and self-sacrifices toward those she loved was boundless, while from that time on she had an abhorrence for men and male society. She had an offer of marriage in 1872, but refused it. She took a trip to a watering place and

returned entirely changed sexually, and made use of expressions which implied that she would only associate with women, had love affairs with them, and let fall insinuations that she was a man. While she was at the baths, in 1874, a young woman fell in love with her, thinking she was a man in woman's clothing. When this young lady afterwards married, Miss X. became very melancholy and complained of faithlessness. Her friends noticed that after her sickness she evinced a decided preference for male clothing and a masculine appearance, while before her illness she had been in nowise other than a womanly character, at least as regards her sexual feelings. The patient was carrying on a purely Platonic love affair with a young woman and wrote her tender love letters.

The following additional references to the literature may also aid the jurist and the medico-legal, neurological, and psychiatric expert in the study of particular forms of this moral pestilence: Hoffman[1] states that tribadism in places of imprisonment for prostitutes is frequent. Andronico[2] found tribadism frequent in similar institutions in Italy. Kiernan[3] found it relatively frequent among the female insane in the overcrowded (five patients to two beds) female wards of the Cook County Insane Hospital. Lombroso[4] states that tribadism has been far from infrequently observed in Italian insane hospitals. It is often introduced by nymphomaniacs, sexual perverts, pubescent lunatics, hysterics, and imbeciles. The clitoris is often found enlarged in the degenerate and the pubescent. Tribadism is frequent in the Turkish harems. Sometimes it originates in the delectable tastes of the male owner. Moll points out that tribadism may develop into sexual perversion through the association of the manipulator or manipulated with the orgasm. Kern[5] takes the ground that the forensic relations of perverse sexual instincts should be determined by the individual in whom these are found rather than the perversion itself. Lord Audley (Howels State Trials, 3, 401), found guilty of pederastic rape on his wife, was executed. He was a sexual pervert, but exhibited no other evidence of insanity. Legrave[6] has reported a lad of degenerated parentage addicted from an early age to masturbation. At school pederasty was learned. He liked to dress in girl's clothing and play with dolls. He had at the age of 16 his first attack of grand mal. He was sent to an insane hospital at 17. Nana, of Zola's romance of that name, was a tribadist and far more jealous of Saten's relationship to other women than of any of her lovers. Dr. L. B. Allen,[7] of Humboldt, Nebr., reports the case of a donkey kept for breeding purposes, which was unable to copulate unless a can were present. Dr. Caton[8] has reported similar cases among animals.

P. S.—I might have included in the context a record of a mild form of intermediate perversion in the person of one of my servants, a colored male creole, who has more womanly than manly attributes. He is 5 feet tall, slenderly built, has large, full eyes, round, symmetrical head, and rather broad hips. Though his mouth is encircled with a growth of short hair which he never disturbs with a razor, he delights in wearing his hair as long as it will grow, and it is several inches long behind and not curly, as it is in front. He wears by preference a woman's high-heeled gaiter button shoe, size 5½, and in the discharge of his household work, waiting on table, etc., he prefers a woman's long white apron, extending clear round his body, to any other form of apron, and wears a white jacket under it. He looks for all the world, when fixed up to his taste, like a woman from the chin downwards. His face is effeminate; his tastes for work are all that way; likewise his voice, though when strained in trying to sing it is often falsetto. He has a special fondness for ribbons, flowers, and kid gloves, admiration for queensware and woman's dresses, keeps a picture of himself and a male friend but no female friend in his room, decorates the rocking-chair in his room with

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[1] Lehrbuch der Gericht Medizen.

[2] Arch. di Psich., Vol. III.

[3] Jour. of Nerv. and Ment. Dis., 1888.

[4] Archivio di Psichiatria, VI.

[5] Über die Klinisch Forensic Bedeutung des Perversen Sexual Triebes.

[6] Arch. de Neur., XI., 1886.

[7] Medical Standard, Vol. XIV.

[8] American Naturalist, 1883.

ribbon, is fond of perfumery, parts his hair in the middle, keeps his wife's clothing and has many things in his possession which are peculiar to women, and makes the impression of a woman about the house in his walk, his talk, and his ways; has been married, but says women are frauds, yet in strange incongruity shows plainly in so many of his actions that he would have been a woman if he could.

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SECTION XVII.—ORAL AND DENTAL SURGERY.

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ADDRESS OF THE PRESIDENT OF THE SECTION, M. H. FLETCHER, M. D., CINCINNATI, OHIO.

Ladies and Gentlemen: In behalf of the officers of this section of the Pan-American Medical Congress I tender each and every one of you a hearty welcome. To our foreign guests I would say, that in consequence of the recent amicable arrangements between all American nations we claim you as brothers and greet you as such. This initial meeting of the Pan-American Medical Congress is an era in dentistry which finds it on a thoroughly founded footing as a profession, fully self-sufficient in many respects; at the same time not differing from other

sciences, in that it depends largely upon several others for its existence, for the attainments of one science makes others possible. After mechanics, dentistry depends upon nothing else so largely as upon medicine and its specialties. The greatest advancements known to medicine have been brought about through revelations by the microscope, and advancements from the same cause have been known to dentistry. Either of these sciences (according to the standard of to-day) would be quite primitive without the recent scientific improvement in the microscope. What would dentistry be to-day without delicate and accurately made instruments with which to carry out its conceptions? Will any dentist dare to say he can treat his patients intelligently without a scientific knowledge of mechanics or of physiology and pathology. He can no more justly say this than other specialists in medicine, for the object of each and every specialty is to repair or restore to usefulness some impaired or lost organ. When dentistry can be separated from the human anatomy then it can be called an independent science; but until then it must be a specialty of medicine, for these two professions only exist in consequence of the diseases of mankind. If it were possible for one to attain to the utmost limits of recorded knowledge and to add to this the experience of a long life of accurate observation, with a memory to retain it all, he would still have made only a beginning in that great school of truth by which we are surrounded. Now, if we divide even recorded truths into various branches of science, are we not culpable when we offer advice and administer remedies for the ills of our fellow-beings if we fall short of our utmost endeavor in gaining knowledge in one small branch? Dr. Hunter McGuire, in his presidential address at the last meeting of the American Medical Association, said: "No physician is fairly discharging his duty who fails to seek information on all these subjects and to take advantage of the knowledge offered him, and he is criminally negligent if he fails to act upon these foundation principles when the occasion arises. The eye can not say unto the hand, I have no need of thee; nor again the head to the foot, I have no need of thee." No more can medicine say unto one of her specialties, I have no need of thee; nor the specialties to medicine, I have no need of thee. What constitutes medicine or the science of medicine? It is knowledge of the truths relating to the health and disease of mankind and the administration of appropriate remedies when disease is present. Then is not surgery a part of medicine and the amputation of a limb or the opening of the peritoneal cavity for the removal of a pathological growth an appropriate remedy? Is not the removal of a tooth a part of surgery and the treatment of diseased teeth comparable to the treatment of the eye. When it comes to the supplying of an artificial limb, is it any more prosthetic surgery than the supplying of an artificial tooth?

These questions seem too self-evident for discussion, and would not be presented here but for the fact that some of our profession have taken that position, that dentistry is not a specialty of medicine. But has dentistry attained the position of a science? Let us see: Science is "truth ascertained," and dentistry, in order to be a science, must be able to show to others some truths peculiar to itself, discovered by virtue of the laws governing its demands; and we think it has done this for the following reasons: (1) The loss of a part of the human anatomy can be artificially restored and made useful by its being retained in position by atmospheric pressure. (2) That in other cases lost organs are imitated and placed permanently in position by being fastened to a part of the human anatomy. (3) That the loss of a part of an organ can be permanently restored with indestructible material. These three discoveries are peculiar to dentistry, and demand for it recognition as a science. But these three things can not exist without following the laws of mechanics, or be practiced intelligently without a knowledge of physiology, pathology, and anatomy. Here is a demand on four different branches of science,

The discovery by a member of our profession that caries of teeth is due to bacteria marks a great stride in the science of bacteriology, but as yet no germ has been discovered peculiar to the decay of teeth. These germs can all be found in other parts of the body and may thrive equally well in other places, but the discovery of the part they play in the loss of the teeth enables us the more intelligently to battle against their ravages. The same enemies and the same methods of their destruction obtain in other diseases and other parts of the body as are adapted in the teeth. The same principles of pathology and physiology obtain about the teeth as to other parts of the human frame, and can we say that dentistry has no part with medicine when these facts are before us? If so, a surgeon or dermatologist could as well take the same position. The principles involved in the loss of the teeth are identical with those by which other organs of the body are impaired or lost, and the only novelty about dentistry is the manner in which these organs are repaired or replaced; but it must adapt many principles from other sciences, the same as do other sciences and branches of medicine. The grinding and adjusting of lenses for the various forms of astigmatism require equal if not superior skill to that of fitting an artificial denture. Every oculist is supposed to know how to direct the optician in the principles of adjusting a lens to his patients' needs, but how many oculists are educated in the art of lens making? On the other hand, every dentist is supposed not only to know what his patients need, but also to know how to manufacture the article itself. Many people go to an optician to buy a pair of glasses which remedy the defects of sight to a certain degree, yet no optician pretends to call himself an oculist or a specialist of medicine because he can fit glasses to distorted sight; no more should a man be called a dentist simply because he can make and adjust a set of teeth. The word dentist should imply more knowledge even than the word oculist or gynecologist, for the reason that a dentist should first have an equal medical knowledge to that of any other specialist; and in addition to this he should be a skilled mechanic, capable of manufacturing and adjusting any device demanded by his patients' needs; and there being no two cases identical, he should be versatile enough to adapt foundation principles to any variety of combinations; and, lastly, he should be an artist of sufficient taste and skill to reproduce nature in his specialty in her most attractive forms, for in the teeth and lips we read much of character; we are either attracted or repulsed by the expression of the mouth, and read strength or weakness in the teeth. Now, when these points are in the hand of man to be reproduced, he must needs be an artist, an anatomist, and a mechanic who can suit the new anatomy to the old with perfect harmony. Does any other specialty of medicine demand so much? As a profession we are dignified by having special legislation governing our practice; and these laws are looked after by examining boards in most of our States. We also have numerous colleges scattered through our land for the education of persons intending to practice this specialty. Why are we thus guarded? Because all our operations are upon and deal with the life, health, and comfort of our fellow-men. Does general medicine or any of its specialties demand more? The facts of the matter are that, whether we will or not, or whether the medical world will or not, dentistry is one of the greatest and most important specialties of medicine, and this too without having mentioned oral surgery as surgery, which many of the members of our special branch practice with unsurpassed skill.

The diseases of the mouth are seldom epidemic, but is not this cavity the vestibule through which many of our most dreaded diseases enter the body? The mouth is constantly inhabited by a number of varieties of bacteria, and is a most perfect incubator for many disease germs, furnishing them proper food and environment for their rapid increase. The condition of the mouth and teeth certainly has a great effect upon the general health in many ways. Hence the need of skillful

and intelligent specialists in dental surgery. The highest skill of the medical world to-day is exerted in efforts to prevent disease, which is equally true in the specialty of dentistry; but with high skill and the greatest of care many mistakes are made. A physician may mistake in diagnosis and be entirely at fault with his treatment; nevertheless, the patient may recover in consequence of nature's tendency to follow natural laws. On the other hand, however, by far the largest per cent of the operations of a dentist are as apparent in their result to the patient as to the practitioner, so that we must be conscientious, careful, and accurate, for there are few excuses for mistakes in dentistry like there may be in the treatment of obscure diseases of hidden organs in other parts of the body.

Dentistry having reached its highest attainments in the United States, we, as an association of practitioners, represent dental opinion from all sections of the world; so let us be careful to take no position which does not represent good judgment and careful thought, supported by scientific truth. As to examining boards in all branches of medicine, I hope to see the United States in the near future in the same position with some European countries, in that the colleges educate, while independent and impartial examining boards pass on the attainments of a student.

Before closing this address I wish to speak of my appreciation of the honor shown me by having been selected to be your presiding officer, and to render my thanks to my fellow-members for the honor and for their loyal support. When I recall the high standing and attainments of so many of my confrères and associates I feel keenly my own unworthiness and beg your indulgence for my shortcomings. Lastly, in the questions proposed, the papers to be read, and the discussion to follow at this meeting, let us so conduct ourselves that the world may see our main object is to ascertain the truth, and that we are free from bigotry and conceit, for these latter traits are not accompaniments of true scientific research. We do not have to argue the question as to our position, but naturally take our proper place both in the scientific and medical world, and are classed among the people of greatest usefulness and highest intelligence.

DISCUSSION.

In response to requests for the members to discuss the points touched upon by the chairman's opening address, Dr. J. Taft said that he was glad that such a paper had been presented on the opening of the section. He approved the views of Dr. Fletcher as to the status of the dentists with relation to the medical profession, and he was glad to note that it was becoming more and more generally held that dentistry was a branch of the great healing art. The feeling is expressed more frequently than ever before that dentistry is a specialty of medicine, but still there are many, including even some of our teachers, who hold that it is a mere mechanical art, or if not this, that it is a profession of itself, apart from that of medicine. It seemed to him that nothing could be plainer than that in all material points dentistry is a part of the practice of medicine. The principles that govern in dentistry are the same as those which underlie medicine in general. Ignoring of this fact ministers to the egotism and self-aggrandizement of those who hold that dentistry is a great profession of itself, which they claim they themselves have created. How does it differ from general medicine? It treats diseases of the same human body, and for the means of alleviating these diseases it depends upon the same courses of treatment in general governed by the same science, the same knowledge, and the same principles of nature. It seems that the day is quite past when this question should be disputed. There is nothing to be gained by having it a separate profession—everything to be gained by considering it a part

of the great profession of medicine and making tributary to our success all the investigations, science, and resources of medicine.

Dr. Jacob L. Williams, of Boston, expressed his satisfaction with the views of Dr. Taft. He felt that dentistry, or as he preferred it should be called, "oristry," expressing the best comprehensive practice, was a specialty of medical science. Perhaps this view was partially because he had originally been educated in dentistry as a specialty of medicine. He said that if we look back we will find that its origin was from medical men, and the science on which it is based we owe to medical practitioners. The facility with which many of the operations may be taken up and performed by the aid of mere mechanical skill and aptitude, and the applause with which mechanical success had at times been received, gave rise to the feeling that it was rather a mechanical pursuit than worthy to be classed as a learned profession.

Dr. S. B. Brown, of Fort Wayne, Ind., said that it seemed proper that we, in a section of the Pan-American Congress, have assumed that dentistry was a specialty in medicine, but, nevertheless, we stand as dentists and take pride in the advance the profession of dentistry has made.

PAPERS READ BEFORE THE SECTION.

PULPLESS TEETH AND THEIR TREATMENT.

By GEORGE EVANS, of New York.

It is doubtful if dental literature presents another subject on which so much has been written with so great diversity of dissenting views as that of pulpless teeth. This is equally true whether as regards the description of the conduct of operations for the prevention of possible lesions or the prescription of remedial treatment for the cure of existing troubles. As almost universally accepted principles govern these matters it is in the details of methods of procedure and therapeutics that these diverse opinions are found to exist. That admitted uncertainty or questionable positiveness to some extent characterize their discussion in almost every case is evidenced by the text-books of our profession and by its periodical literature and clinical reports. A general contemplation of the subject under these circumstances is at times apt to be somewhat confusing as well as surprising when we see such expressed divergence of opinion coming from those most eminent as practitioners. In view of these facts, therefore, in presenting before a body such as this a paper on pulpless teeth, which must necessarily discuss so many disputed points, I feel conscious that I have undertaken a difficult task, and one which might be deemed presumptuous should I assume to be able to enlighten you in an extraordinary degree or to entirely harmonize your opinions. I shall endeavor to present for your consideration, discussion, and criticism an intelligible conception of the subject, embodying a liberal valuation of points in treatment, based as much as possible on science instead of empiricism, and practical experience rather than theory. I shall hope thus to assist in arriving at conclusions which will be ultimately universally recognized as correct in surgical procedures and most suitable in therapeutic treatment.

A pulpless tooth is understood to be a tooth with a non-vital pulp, or one from which the pulp has been removed with consequent loss of vitality of the dentine. Respecting the remaining structures of such teeth we have one of two conditions presented, the first where the vitality of the entire cementum is retained, the other with non-vitality of a part of the cementum on the side of the root, or of the portion constituting the apex, through the action of devitalizing agents or the presence of some lesion. Independent of other pathological conditions present, according to the degree of existing vitality as contributed by the connective tissue, the pericementum, favorable effects of treatment may be expected and permanent results assured. The treatment of pulpless teeth or roots for the prevention of future trouble or in connection with the cure of existing lesions consists in as thorough a performance as possible of the following operations: (1) Removal of the contents of the root canals; (2) disinfection of the root canals and dentine, and the establishment of permanent aseptic conditions by mummification of the contents of the tubuli; (3) closure of the apical foramen.

PREPARATION OF ROOT CANALS.

A knowledge of the usual positions, forms, and variations of the roots and canals in the different teeth is essential for a generally successful performance of this operation, which is greatly facilitated by obtaining direct access to the root

canal by a proper removal of the tooth structure. This in a lower molar is illustrated in section in fig. 2, a. The slot in the occluding surface, it will be seen, is sufficiently extended to give direct access to the canals of both roots; an approximal decay requires similar extension (b). In the incisors enough of the palato-approximal wall should be removed to allow instruments to be used with the least possible curve, as shown at c, fig. 2, in a central incisor. Should this, in the opinion of the operator, involve too great a loss of tooth structure, a small hole can be drilled in the palatal side, as seen in fig. 3, and direct access to the canal thus obtained. The drilling of holes such as these is best confined to centrals, as if they are made in laterals and both approximal sides should, at some future time, decay, the palatal wall is seriously weakened by the loss of so much of its structure, as shown in fig. 3. In molars, when cervical decay of moderate extent involves the vitality of the pulp and the contour of the coronal section is only slightly encroached upon, an independent entrance to the pulp cavity had best be made in the center of the occluding surface for the treatment of the root canals, the cervical cavity being filled separately. The principles here outlined can also be applied to cuspids and bicuspids. In crown work on the anterior teeth the removal of the coronal section directly exposes the pulp cavity.

In preparing bicuspids and molars for all-gold crowns the leveling of the occluding surface and removal of a portion of the side most involved by decay should be preliminary. A proper opening having been made, any remaining portion of the pulp is removed with broaches. A few fibers of cotton should be twisted around the serrated portion of the broach to allow of easy removal in case of breakage. The canals are then, guided by frequent explorations with a fine probe, carefully enlarged with Gates Glidden drills. At least three sizes of drills, large, medium, small, are required, each for the right angle and the direct hand piece. Very little, if any, pressure should be put upon them when in motion, as they will move forward sufficiently of themselves. Under pressure the formation of a false passage in a curved root is possible, or the small drill might be broken off or forced through the apical foramen with disastrous consequences where alveolar abscess did not exist. Neither should drills be forced into a canal closed by calcification, nor into the canal beyond the line of the apical cementum, nor through a constriction which a fine flexible probe can not enter, nor around a curve sharp enough to be unsafe to pass. A slight pain, of which the patient should be instructed to notify the operator, is experienced when they enter the zone of cementum which composes the end of the root, if its vitality has not been impaired by improper use of arsenic in devitalization of the pulp or by alveolar abscess. The probe-like points of these drills do not cut, but simply guide the drills and confine them to the line of the canal. They should be gently given a constant slight forward and backward motion in the canal, and treated more as reamers than drills. Unless thus used the coarse serrations of the head of the drill may fasten in the canal, when the head is liable to be broken off. The occasional quick withdrawal of the drill from the canal during the process of drilling will aid removal of the débris.

The depth to which a canal may be enlarged or reamed is regulated by its actual length and previously ascertained condition, and the diameter of the enlargement by the shape and dimensions of the root. The use of these drills is condemned by some operators for reasons properly attributable to their careless or improper employment, but they are indorsed, in experienced hands, for their adaptability to the work under consideration. They should be frequently sharpened with a suitably shaped Arkansas stone. The shank just back of the head should be large enough to assure strength. The temper should be such that the steel might be bent but not broken, even though the edges of the serrations become sooner dulled in consequence. The Palmer root-canal excavators also will be found serviceable to open up a canal and enlarge it in accordance with its original shape. The

reaming of a canal not only simplifies the operation of filling, but also opens up the ends of the tubuli, and facilitates the permeation of the dentine by antiseptic agents, the advantage of which must be admitted when a septic condition is present. Under favorable circumstances the line of the zone of cementum at the end of the root is a safe point to ream to and stop at.

I am aware that some few operators state that they do not ream out root canals, but claim to treat and fill them as well as those who do. Careful investigation of the subject seems to demonstrate that the majority even of these, in obtaining an entrance to a canal, enlarge the orifice and to some extent really ream out the canal. The reaming, then, is with them only a matter of extent. I also find, as a rule, that in proportion as root canals are properly, I do not mean excessively, reamed and opened up, so are subsequent operations on them satisfactorily performed.

In the treatment of alveolar abscess the canal should be enlarged as already described and the foramen, if possible, opened up with a smooth broach instead of a drill. Drilling through the end of a root or extensively into the cementum at the apex is to be condemned, except when it is desirable to afford immediate relief to the patient in cases of acute abscess. In chronic alveolar abscess the immediate or more prolonged action of agents sealed in the canal for a day or more, for the purpose of disinfection, will usually facilitate the passage of a broach or permit peroxide of hydrogen to be forced through. When this is not the case, a fractional part of a drop of aromatic sulphuric acid, held in position in the end of the canal on a few shreds of cotton for twenty-four hours, will usually effect an opening unless exostosis exists. My objection to attempting to drill through a foramen is that although the main line of the canal may be straight or nearly so, the extremity of the root to some extent curves in a large proportion of cases, a condition impossible to always determine, and as a sharp-pointed drill has to be used, it will move rather in a straight line than a curve, so that a passage to one side instead of through the foramen is likely to be made. This leaves the apex in a form not conducive to successful treatment unless a burr is subsequently introduced externally into the region of the abscess, and that part of the apical section of the root removed. (Fig. 4.)

THERAPEUTIC TREATMENT OF THE ROOT CANALS.

Pulpless teeth are presented for treatment in either of the four following conditions: (1) Where a healthy or non-putrescent pulp has been extirpated from the canals; (2) where on opening into the pulp chamber it is found empty and dry, with the pulp mummified, or the root canal calcified and the root externally in a healthy condition; (3) where a pulp is found in diseased or putrescent condition; (4) where alveolar abscess is present and a septic condition of the canals and dentine exists.

In the first and second classes the treatment should be directed to assuring a continuance of the existing aseptic condition and as immediate as possible filling of the canal; in the third and fourth classes to bringing about an aseptic condition by disinfection and sterilization and making certain of its future maintenance, including incidentally the cure of any existing disease of the external membrane or of the alveolus. In cases of the first and second classes water and saliva should be excluded from the pulp chamber and canals during their entire preparation and filling. The instruments should be sterilized, and the broaches, if serrated, had better be new. In the third or fourth classes exclusion of saliva or water is not necessary in the preliminary work on the canal; water may be freely used until the process of disinfection and sterilization is commenced. Then and thereafter its entrance must be prevented. To this end the rubber dam should be applied if practicable. When it is not, as frequently occurs with roots and teeth

badly affected with cervical decay, other means of keeping out moisture should be resorted to. In such cases, during each interruption in the operation, the entrance to the canal should be filled with absorbent cotton saturated with a suitable essential oil or antiseptic fluid, and saliva thus excluded. After the canal has been properly opened up and its contents removed, it may be washed out with peroxide of hydrogen and wiped out with absorbent cotton.

The next point in the conduct of the operation is to secure as thorough a state of dryness in the pulp chamber by the use of air at a temperature higher, as it leaves the nozzle of the ordinary or the A. S. Richmond hot-air syringe, than is comfortable for the finger. A root-canal dryer, with the end tapered as fine as a broach at the point, is then introduced into the canal. I prefer the form in which the point is made of silver and the bulb portion of copper. As silver possesses remarkable properties as a thermal conductor, the heat is transmitted to the point of the probe very rapidly. The probe being inserted as far as possible up the canal, the patient is directed to raise the hand as a signal should the heat cause pain, when the probe must be moved up and down or withdrawn for a moment. This procedure, following the previous application of the hot air with the syringe, evaporates the moisture and aids the escape of any gases present in the root canals and the open ends of the tubuli. The point of the root-canal dryer acts as a sterilizer and may be applied so hot as to carbonize any organic matter it reaches in the end of the canal, a portion of which can each time be removed on its point. As the silver point can be tapered as small as the finest broach, canal contents which it has been impossible to remove may be reached or rendered inert. In cases of the third or fourth classes, sepsis being present, the heat is very serviceable, as it aids the escape of gases from the canal and dentine and acts as a germicide. When in this dry and heated condition the dentine is in the best possible state for the application of antiseptic agents.

The suitability of various antiseptics in the treatment of tooth structures, their effectiveness and permanency when so used, singly or in combination, are subjects on which great diversity of opinion exists, and which have of late been made the object of clinical study and scientific investigation and discussion. Many antiseptics in common use, being coagulants of albumin, obstruct the dental tubuli, and consequently limit or retard diffusibility throughout the dentine. This is the objection to the use of carbolic acid, creosote, and like agents, additionally to which may be named their inefficiency to accomplish in certain conditions the end sought, and as well their eventual absorption from the dentine. Recent investigations seem to give preference to such antiseptics as are non-coagulative in their action. Of this character are the essential oils, many of which, according to Miller, Harlan, and others, possess antiseptic power much greater than has been commonly attributed to them. Acidulated solutions of bichloride of mercury, peroxide of hydrogen, the new agent sodium peroxide, especially in preliminary treatment, and various preparations of iodine, which exert chemical action and retain antiseptic properties for a great length of time.

The selection of antiseptic agents is important and is indicated by the conditions presented in a pulpless tooth. Cases in which a healthy pulp has just been extracted, or in which the canal is aseptic, are different from those with septic dentine or diseased or putrescent pulps. In the first-mentioned condition, with or without antiseptic treatment, favorable results usually follow root filling, the advantage of a reliable antiseptic agent in the canal being only to better insure the continuance of a state of asepsis. In the second condition the state of the dentine, and consequently the treatment to be effected, are entirely different. We need the action of agents that will not only destroy ptomaines, but exert a chemical action on sulphuretted hydrogen and other ethereal ammoniacal gases, the products of putrefaction, and entirely eliminate them. On this depends the successful treatment of such cases,

as the pressure and expansion of these gases are a certain cause for constant peridental imflammation, and so long as they are present in the slightest degree in a canal it is in an unsuitable condition to be closed. Carbolic acid, creosote, or the essential oils in such a condition exert no chemical action on these gases, merely disguising their odor, though by repeated dressings of cotton saturated with these agents the gases are absorbed by the cotton and to an extent slowly eliminated. What is required is the action of agents whose elements possess an affinity for these gases and will immediately decompose them, forming new combinations and entirely destroying the character of the gases.

Regarding the use of agents in the treatment of septic dentine of pulpless teeth, Dr. W. F. Litch, in a paper published in the Dental Cosmos, February, 1882, says:

In this respect a careful discrimination must be made between the powers, respectively, of such antiseptics as carbolic acid, creosote, oil of cloves, oil of thyme, etc., and such other antiseptics as chlorine, bromine, and iodine, which, in addition to their antizymotic power, are true chemical antagonists of those sulphuretted hydrogen compounds of which putrefactive gases are constituted, such gases being immediately decomposed by them; their hydrogen element going either to chlorine, bromine, or iodine, to form, respectively, hydrochloric, hydrobromic, or hydriodic acids, the sulphur being in each case precipitated. * * * An antiseptic agent, as carbolic acid, can not be said to be a true disinfectant in the sense that all the products of putrefaction are decomposed by its presence. No matter how thoroughly the odor of putrefactive gases in a room or in a tooth may be masked or disguised by the characteristic odor of carbolic acid, creosote, oil of cloves, or, indeed, any antiseptic oil, the gases are none the less present, although their odor is neutralized; the disinfection is only apparent, not real. The further formation of putrefactive gases may be prevented, but the decomposition of those already formed must be accomplished by those chemical agents already cited.

I bring the facts respecting these agents emphatically to your notice, as I am conscious that a large proportion of practitioners at the present time still entirely adhere to and depend on carbolic acid or creosote exclusively for the treatment of the conditions presented in pulpless teeth. In accordance with these principles the use of iodine is indicated, and preference is given to its use in practice to that of the other agents mentioned. Its effects are best obtained from some one of the preparations now in use; aristol, for instance, its odor being entirely unobjectionable, in a strong solution in one of the essential oils. In my practice I favor the oil of cloves, cassia, and eucalyptus. I consider the oil of cloves more sedative in action than the others. I make it a point to flood the canal with the solution, thereby to some extent saturating the heated, dried dentine as well as the cementum at the apex. A more effective saturation can be accomplished by again drying and heating the dentine and applying the solution, or by filling the canal with cotton saturated with the solution, hermetically inclosing it and letting it so remain for a day or two.

I do not claim that coagulants, such as creosote or carbolic acid, are entirely non-diffusible in devitalized dentine or cementum, as decomposition or putrefaction effects elementary changes in the contents of the tubuli, but that their action is slow and limited compared to that of the essential oils. They have also the objectionable feature of being irritants and unsuitable where acute or chronic inflammation of the peridental membranes is present. I wish to mention this forcibly, for there are prominent men in the profession who advocate carbolic acid as the most suitable and in the treatment of alveolar abscess as the best remedial agent, declaring with great positiveness that the use of all other agents is useless and a waste of time. The history of the indiscriminate use of carbolic acid and creosote, in the practice of others and of myself, has convinced me that they are not in all cases and at all times suitable therapeutic agents to use. When a healthy pulp has just been extirpated and "immediate root filling" is practiced, the use of carbolic acid, creosote, or solution of chloride of zinc is best indicated, the condition then presented being entirely different from that where the pulp is

diseased or putrescent or the canal is in a septic state. When a healthy pulp has been removed, its minute fibrous connections with the walls of the canal and the vessels at the apical foramen are severed, and the action of an escharotic antiseptic agent, such as carbolic acid, is in fact then indicated, as it acts as a coagulant and instantly seals up the ends of the tubuli. If "immediate root filling" is not to be practiced, then the presciption of such agents as the essential oils, with aristol or iodoform, seems more suitable, as a slow but certain mummification of the non-vital organic matter it reaches follows. Moreover, the oils possess advantages over the coagulants mentioned in not being miscible with water, and thus being eliminated, so that by their use the antiseptic action is perpetuated.

From these statements it might be asked what special advantage is there in the much-discussed method of "immediate root filling" beyond that of the time gained by the operator? I would answer, that in the proper conduct of treatment there is none. A canal with an antiseptic dressing, with the orifice of the canal and cavity hermetically sealed securely with gutta-percha or oxyphosphate of zinc, is free from the danger of inroads of microörganisms or of the supervention of sepsis for a reasonable interval of time. The disadvantage of immediate root filling is that should some fragment of the pulp remain in the extremity of the canal it fails to receive the benefit accruing from the reäpplication of antiseptics, which would better assure inertness by mummification.

In brief my conclusions are that in cases of pulpless teeth, where an aseptic condition of root canals and dentine exists and immediate root filling is to be practiced, the use of coagulants such as carbolic acid or creosote, alone or in combination with other suitable agents, is permissible; but when sepsis exists their use is contraindicated in favor of non-coagulants; that treatment with such agents should be followed and the filling of the root be temporarily deferred; that if alveolar abscess exist treatment through the apical foramen by injection should be restricted to the use of non-coagulants until disinfection of the dentine is effected.

There is such a thing as overtreatment, an unnecessarily frequent renewal of antiseptic dressing in root canals, thereby aggravating or producing irritation of the pericementum at the apex of the root. Such cases may be relieved by washing out the canal with alcohol, and applying the alcohol on the dressing instead of the agents previously employed.

CLOSURE OF THE APICAL FORAMEN AND FILLING OF THE CANAL.

The object of root-canal filling is to prevent the entrance of the fluids through the foramen and avert, in case of the formation of gases, irritation of the peridental membranes by their pressure or presence. Respecting this branch of treatment, I might say that there is no difference of opinion as to what ought to be done, but preferences exist as to the method of procedure and the materials to be used. Gutta-percha or oxychloride of zinc are generally accepted as the most suitable. Either gutta-percha in the form of chloro gutta-percha or the oxychloride of zinc, mixed thin, can be pumped or placed in the extreme end of the canal with the aid of a broach or fine-pointed probe. This is one of the advantages that commends the use of these materials. When the chloro gutta-percha has been placed in the apex the remainder of the canal can be filled with the prepared cones of solid gutta-percha until no more can be inserted. A current of hot air should then be thrown on the protruding ends of the cones at a temperature sufficient to soften them and warm the dentine, when they should be gently pressed but not suddenly pushed up in the canal. A slight twinge to the patient will usually be the signal of their complete impactment in the canal. The solid gutta-percha absorbs what little chloroform was present in the chloro gutta-percha and the heat also aids its evaporation, so that the shrinkage, so often urged as an objection against the use of

chloro gutta-percha, is reduced to a minimum. An advantage possessed by oxychloride of zinc over other materials is its antiseptic qualities; its disadvantage, the difficulty attending its removal from the extremity of the canal should supervening conditions require it. I frequently use it in combination with gutta-percha, filling the extremity and part of the canal with gutta-percha and then the orifice and pulp chamber with the oxychloride. Wood and metal shaped to fit the canal are also much used to fill root canals, but unless a small quantity of chloro gutta-percha or oxychloride of zinc is placed in the extremity or on the point used the entire closure of the canal is doubtful. The use of cotton as a filling in root canals is to be condemned unless it is sterilized or iodoformized and saturated with chloro gutta-percha previous to insertion. Asbestus by some is given preference to cotton. Tin or gold foil is difficult to insert without vacuoles. Paraffin in combination with a small quantity of aristol, as a material to fill root canals, has been suggested by Dr. Kirk, especially after the use of sodium peroxide. Sodium peroxide, being a most active solvent of albuminous matter, in a measure frees the ends of the tubuli or a canal of their organic contents, a condition favorable for the use of paraffin. Paraffin is aseptic and melts at a low temperature, and can, with a heated root-canal dryer, be flowed into the ends of the tubuli or a minute canal that was not considered safe to open up. Ordinary gutta-percha should be used to close a foramen when an abscess has just been treated by injecting through it. The length of the canal should be measured with a probe and gauged with a small perforated disk of rubber dam slipped upon the instrument. The gutta-percha should then be carried to position on the point and an allowance made for the displacement of the instrument. As oil of eucalyptus is a solvent of gutta-percha, the application of this oil alone or in combination with iodoform or aristol is recommended in the final treatment when chloro gutta-percha is not used, as better adhesion of the gutta-percha to the walls of the canal is thus obtained. In a case of chronic alveolar abscess, where amputation of the apical section of the root is to be practiced, oxychloride of zinc makes a most suitable filling.

It is not my intention to discuss the subject of alveolar abscess more than to say that, it matters not what form it may present, treatment primarily should consist in a thorough disinfection of the canal and dentine of the affected root, and finally the adoption of such measures as will maintain a state of asepsis.

I feel that I can not well close the paper without some comment on the method proclaimed by Dr. Herbst of treating pulps in teeth ordinarily classed as pulpless, and which has of late been given considerable prominence. The idea of this method is to devitalize with cobalt only the section of the pulp in the pulp chamber, remove it, and seal up the portion in the canal, adopting measures during the operation to maintain asepsis, as the pulp will then probably remain inert in case of non-vitality supervening. The object is to simplify and lessen the work on such teeth and retain some circulation in the dentine from the remaining vital pulp in the roots.

The objections to this method, briefly stated, are: (1) The action of cobalt or arsenic in the devitalization of a pulp is not controllable. (2) Even though the vitality of the pulp left in the root canals is retained an atrophied and then a non-vital condition is liable to follow; also, as a large percentage of exposed pulps are diseased, in such cases sepsis will supervene. (3) The method in result is similar to the operation commonly performed in which antiseptic measures are adopted, but lacks thoroughness respecting the treatment of root canals. (4) Its performance in detail, as described, would require in many instances as much time as the recognized method in practice. (5) Present recognized methods show an exceedingly low percentage of failures, and the practice of Dr. Herbst's method would commence an era of doubt and uncertainty respecting operations on pulpless teeth. (6) The introduction of such a method in the teachings of

the schools and elsewhere would have a tendency to encourage a lack of thoroughness in operations on pulpless teeth. I make this criticism with due deference to the investigations and statements of Dr. Herbst and respect to the gentlemen in this country who have advocated his method.

Having presented to you my conception of what I consider should be the treatment of pulpless teeth in accordance with correct scientific and rational principles, and as dictated by modern methods of practice, I might ask the question, Are these described operations always possible of perfect performance? We work at times under great difficulties, in places unseen, and we can not assert what is unknown. I consider it far preferable to suspend efforts to effect thoroughness in a root canal than to risk penetrating foramen or wall; better to fail to thoroughly impact the filling than force it through the foramen into the apical space. The former would be designated a failure; the latter would be a malperformance. Sound judgment counsels caution, which, with knowledge and skill, will, as a rule, insure present and future satisfactory results in these operations. To the educated, skilled dentist of the present day few pathological conditions of the teeth are uncontrollable, and in mechanical operations extraordinary results are possible of attainment. Treatment of pulpless teeth in accordance with the principles and methods advocated I believe will be classed among his greatest successes.

DISCUSSION.

Dr. Knapp, being called upon to open the discussion, said that he could commend the paper highly, though in some points his practice differed with that of the author.

Dr. Brown said that the subject of pulp-canal treatment and filling was one of great importance in practice, and we can not talk and think about it too much. Drilling out and enlarging the canal he thought not good practice; the better treatment was to take the canal as we find it. He had not much confidence in filling root canals with gutta-percha alone; but preferred gutta-percha with chloroform, as it could more surely be got to the apex of the canal. He had ceased to use gutta-percha points, as the solvent used in making the points was liable to soften it so as to make the filling imperfect. He preferred the use of copper or tin points, as with them he felt that he could make more reliable filling.

Dr. Noble said that in the main the paper agreed with his own notions in regard to the preparation of pulp canals, and certainly where the author deprecated the use of creosote and carbolic acid. The time was when these two drugs were considered a necessary part of the outfit of every dental office, when in truth one could not enter a dental office without being aware of their presence. He did not think the office should be saturated with these unpleasant odors; but thought that the essential oils with the peroxide of hydrogen and other well-known germicides were much to be preferred in use and much pleasanter. Of course, we still have iodoform, but with care, annoyance from its odor is not serious. He used aristol and eucalyptol oil in the preparation of root canals with success. He thinks oxychloride of zinc the best filling for canals; upon a shred of cotton it can be carried quite to the end of and thoroughly fill the minute crooked canals. He has but little faith in any filling in a canal so placed that it could be removed. He feels that the removal of any filling would cause irritation enough to make trouble and set up inflammation. He would sooner depend upon treatment from the outside rather than open up through the canal.

Dr. Jacob L. Williams, of Boston, did not agree with the paper in regard to the best material for filling the root canals. He thought that no matter how thoroughly or carefully a root canal is treated and filled, there was always a possibility of trouble some time in the future, which would necessitate the removal

for relief and treatment. It might be all right for a long time, even six eight, or ten years, but then perhaps on account of a low state of health in the patient, an inflammation would set up, and it would be desirable to remove the filling for treatment. It was so nearly impossible to get out gutta-percha fillings that he did not feel it wise to insert them. His practice was to take rods of lead, zinc, tin, or copper, and having shaped them to fit the cavity, embed them in a mixture of tincture of benzoin with oxide of zinc. This paste will make a tight permanent filling. He allows the end of the rod to extend into the pulp chamber and turns it over after it is set in the canal and fills over it with gutta-percha. In case of necessity, it is easy to remove the gutta-percha, and then get hold of the end of the rod and draw it out of the canal. In regard to the oxychloride of zinc and the condition in which it should be used: The antiseptic qualities of oxychloride of zinc used to be depended upon for the preservation of the teeth whose pulps were endangered, but in many cases the teeth became discolored and upon removing the fillings the oxychloride was found not to be solid, but simply a mass saturated with septic matter. For this reason he had lost confidence in it as a permanent antiseptic, and uses oil of cassia or eucalyptol, or liquid paraffin, which is a vehicle for such antiseptics.

Dr. J. Taft spoke of the desirability of preserving the vitality of the pulps of the teeth, and the necessity of impressing both dentists and their patients with the importance of preserving their vitality. Our patients are very careless in this regard. It is difficult to make many of them understand that a living tooth is better than one with a devitalized pulp. If they would appreciate this as they should we would have fewer devitalized pulps to deal with. He had patients who had been under his care for years and years, who had not a devitalized pulp in their mouths, because they saw the necessity of watching their teeth and having them properly cared for in time. He would emphasize to all dentists the necessity of preserving the vitality of the pulps, and teaching their patients the importance of these organs. When a person has anything the matter with his eye he needs no promptings as to the necessity of having it promptly and skillfully cared for, as everyone feels the importance of sight; but a tooth is neglected till the suffering becomes unendurable, and then if it can only be relieved by the death of the pulp it is sacrificed, when, if treated in time, it might easily have been saved. It would be much better for the interest of both patient and dentist if the treatment was had in time. But do what we will, these pulpless teeth will come to us. The question is, What shall we do with them? Beyond and beneath the detail of management lie the conditions of each case, which must be studied. A tooth is presented to be put in the best possible condition. What shall be done with it? Deal with it as with a piece of metal? Not at all. The teeth are subject to different conditions, which must be understood. Some teeth are deteriorating, but will go on for years and years, and at last will be lost; others more rapidly will go from bad to worse and soon develop active disease. We should give attention to these varying conditions, because they affect the treatment which depends upon the susceptibilities of the living tissues. Some teeth may be very troublesome, and yet, because of strength and power of the system, they will recover and remain quiet. All these conditions will modify the treatment. When we have a dead pulp to deal with we must first free the canals and the tissues contiguous of everything that will cause disease. Remove mechanically all that is possible; what may remain neutralize and destroy with chemical or antiseptic means. Then close up the space with something that will not be an irritant to the tissues beyond. Keep out all that will produce poisonous gases and cause the trouble to recur. This should be so well done that there should not be any thought of removing the filling for re-treatment. If trouble should ensue afterwards, it will be because the operation was not

thoroughly done at first and an irritant was left, which will have given rise to abscesses. The better way, then, will be to penetrate to the root from the outside and cure the abscess so. The general principle in treating a pulpless root is to fill it up completely with metal, wood, or anything else that will accomplish the purpose. He spoke of his new preparation, pyrozone, and recommended the dentists to use it.

Dr. Williams said that the chief characteristics of a root filling were that it must be antiseptic and that it must completely fill the root canal. He spoke of operations of a surgical nature where, in after years, owing to a low vital state, trouble occurred at the seat of operation, and said that such trouble, under like conditions, was liable to occur in a tooth that had been devitalized and the canals filled.

Dr. Fletcher said that he realized that the subject had been pretty thoroughly gone over, especially as far as the treatment was concerned, but he wanted to speak of another difficulty with these cases. In surgery we have a definite treatment plainly indicated. If there is a sarcoma, or a tumor in the abdomen, we know they must be removed. And so in medicine there is a recognized lesion and a definite theory of treatment. Is this true in dentistry? Do we first diagnose the case correctly? Has anyone so defined these conditions that we can say this is periostits or there is pus at the end of this tooth, and can we tell what is the cause of the trouble? He did not think it had been so well defined that we can discuss it as we should. When we know what is the matter we know what to do, but we do not have such perfect definitions as to understand how to discuss it. He hoped someone would take up the subject and systematically name the conditions so they would better know what they were talking about.

Dr. Taft said it would be difficult to do that, because the conditions were so various. It would be necessary to go to the very depths of the pathological conditions and the physiological conditions, and then it would be impossible to define them so that any other man would recognize them. It requires thorough knowledge of the conditions for each man.

Dr. Evans said that his paper, he thought, answered some of the questions brought up in the discussion. He had stated that a metallic filling would not, except in connection with some soft material like oxychloride of zinc or chlora percha, successfully fill the foramen. In regard to removing the filling, it is all right to fill so that it can not be removed if you could be sure it would not be necessary to remove it. If one could be quite sure of this, the plan of Dr. Morrison, which was to gauge a piece of wire the shape and length of the canal and mark the length with a notch cut in the wire, which would enable the operator to break the wire off at the notch, would be a good plan; but in case it was necessary to remove such a filling, it would be found almost impossible to do it. He thought the new preparation for clearing out pulp canals, sodium peroxide, an agent that will surpass anything we have heretofore had. It is a solvent, and opens up the canals and tubules in a wonderful manner. He thought with Dr. Fletcher, that the subject of the pathological conditions of the teeth had not been studied up as it should, and it would be well if the books described it better.

PREPARATORY KNOWLEDGE FOR THE STUDY AND QUALIFYING EDUCATION IN THE APPLICATION OF PRINCIPLES FOR THE PRACTICE OF SPECIALTIES IN MEDICINE AND SURGERY.

By JACOB L. WILLIAMS, M. D., of Boston, Mass.

A highly encouraging indication of progress in general professional education, as well as in our special department, is the increasing appreciation of the importance of such preliminary knowledge and training on the part of the student as will enable him to comprehend accurately and readily the instruction given him in his professional pupilage. That this is essential to the best progress in study no one disputes, and it requires no argument. But there is another need which seems too much neglected, or too often only casually implied, in the course of the professional study intended to fit the student to practice. This need is in the matter of direct education in the general principles of medicine and surgery: that is, in the laws that govern the vital economy in health and disease, the knowledge of which, with the trained ability to apply it, is the only basis of the soundest practice. I say trained ability; for it is not common for the average student to recognize readily the correct relations and application of those general principles to the cases he may see in practice. It is only the few with special natural intuition that can do so without being constantly reminded of those relations by their teachers, by which constant training they may in time acquire a habit of such application. That skill in operation and manipulation is one essential no one questions; but if that is all to the neglect of knowing how and when to properly apply that skill, the student is only half fitted for practice, and that only by rote, as it were, as his skill is quite liable to be misdirected; and the axiom in engineering holds good here, too, that "the greater the skill misapplied the greater the blunder." This ability to discern principles in the application of skill distinguishes the professional practitioner from the simple mechanic, and those possessing it, with an ethical basis of character, may have no doubt that they belong to the great profession of ministers of nature in treating human ills.

When, in response to invitations, I sent to the secretary the synopsis of a paper that I hoped, but could not promise, to write out in full, I apprehended the pressure of affairs which has justified me in that provision. But I will say a few words that may perhaps make plainer the idea I wished to present. In regard to education as preliminary to the study of medicine and surgery, it is generally conceded that with the presumed mental training the more liberally equipped the student is in all knowledge having any bearing on his proposed professional study the more satisfactory will be his progress in that study. But with the best preliminary training we often find that the medical pupil needs reminding of the facts and principles the knowledge of which is supposed to be a part of his preliminary acquirements. So also when he comes to the learning of facts and principles that underlie the laws of health and disease, the average student most especially needs constant training in the relation of those principles to clinical or actual cases. This is what may be called qualifying education for practice of general or special medicine and surgery. Perhaps this qualifying need is at present most observable in regard to the practice of specialties, of which that of oristry is by no means an exception. With the ambition, laudable in itself, to excel in manipulative skill, how often do we see the unfortunate results of forgetfulness or ignorance of the principles that should direct or restrain that skill. To illustrate: It is well known that a heavy blow on the head is apt to produce paralysis of a longer or shorter duration. It is also known, I think first proved by the elder Agassiz, that from continuous lighter blows, the jarring irritation of the peripheral membranes of the brain, a similar result may follow. Ignorant of this fact or principle, a dental operator who prided himself on his skill in building up gold fillings with a heavy

mallet once subjected his patient, a man of fine nervous organization, to sessions of several hours a day for five consecutive days in building down the six upper front teeth, with the result of paralysis of the patient, from which he only partially recovered, and from which he died in about two years. Take another actual case: It is well known as a surgical principle that tissues of low organization, like ligaments and cartilage and the gums, when wounded, draw more largely in healing on the constitutional vitality of the patient than do the more highly organized tissues of the body. Ignorance of that principle resulted fatally in the case of a lady of a moderate degree of health and strength that required constant care, whose dental attendant extracted sixteen teeth at one sitting. On going home she took to her bed and died from vital exhaustion in a fortnight. Now, no doubt these operations were skillfully done, but the skill was misapplied; and you know the axiom: "The greater the skill misapplied the greater the blunder." Many less serious cases might be mentioned. Now, what I would urge, as from my observation for some years in our own specialty, is the greatest need of more and constant attention, in the schools and with practitioners, to what a zealous doctor, now deceased, used to call the "underlying principles as the basis of correct practice."

With a knowledge of those principles, and how to apply them, one need have no question in what domain he is properly working.

DISCUSSION.

Dr. William Carr asked Dr. Williams where he thought the fault lay for the lack of the preliminary knowledge needed as the basis of dental professional education.

Dr. Williams answered that it lay in the fact that the dental schools did not teach the principles of medicine and general surgery to the students, and did not impress the necessity of the application of these principles upon them. The highest ambition of many is to do skillful operations. Any jeweler could do these operations. Unless the dentist has a thorough knowledge of the fundamental principles of medicine and surgery, he will never be sure to practice his profession worthily. He related an instance of a pupil who was about to graduate from one of the schools in Boston, who showed by his questions that he was wofully ignorant of the plainest principles which govern the treatment of diseased teeth. Under the present system of teaching students are too much taught to do things by rote.

Dr. Carr said that the fault lay in the want of a rule insisting upon a preliminary fitness before a student was admitted to a dental school. In New York State before a student can be admitted to the study of law or medicine he must have a degree from some reputable institution of learning, either the bachelor of arts or master of arts, or at least a certificate of fitness from the regent of the university. He thought the day was not far distant when the dentist would be really as much a specialist of medicine as the oculist, when it would be required of him to first get the M. D. degree, and then his dental degree as a specialist. There is a movement on foot now to accomplish this result in New York.

Dr. Noble asked if they looked up the history of students before matriculation, to learn whether they were possessed of these qualifications.

Dr. Carr said they did not now, but they intended, or at least hoped, to have it so in the future. At present the preliminary examination is of the most trifling character. This thing will never be righted till we take it out of the hands of the colleges. It is too much of a temptation to the officers of a college when a young man says that he can not afford to study so as to pass a reasonable examination, and who promises to do his best during the course. He did not mean that the fee

was the temptation, but that the sympathies of the faculty were worked on. They make a mistake, for it would be better for the student to be held back for two years, if necessary, till he has had time, by study, to train his mind for the reception of the knowledge he must master in order to practice dentistry intelligently. The fault, too, often laid with the preceptors of the students or the dentist who is asked to advise the young man about the study of dentistry. In every case he insisted upon his students possessing a good general education preliminary to their going to a dental college.

Dr. Noble agreed that the preliminary examinations in the dental colleges were generally very trifling, and that every dentist should refuse to receive any student till he has fitted himself by study to enter the college.

Dr. Carr related an instance of a young man who, having failed entirely in the effort to go through the course in the dental college, set up an office, called it a dental association, and began the practice. Having been arrested for practicing illegally, he promised not to practice in the State if he was released. He was released and came to Dr. Carr and asked him what he was to do; said he could not go into any other kind of business, but could make a living if allowed to practice dentistry. Dr. Carr told him to go to the college. He said he could not, as he was on bad terms with the professors. He opened another office, was arrested, and fined $100. He then applied to the college, but failed completely in his preliminary examination. This was in March. In October he passed the preliminary examination, got into the college, and in the course of five months passed the junior, senior, and final examinations, got his diploma, and is now practicing, and no one can hinder him. This is an example of how an ignorant fellow can get through the college without getting well grounded in the fundamental knowledge of medicine and surgery.

Dr. J. F. Thompson said it was gratifying to compare the dentists of to-day with those of forty years ago, and see how much higher is their present status, in comparison with their medical profession, than it was then. At that time the medical profession did not look upon dentists with much favor; now we meet as a section of the first Pan-American Medical Congress, and we must sustain ourselves on that high plane. We must educate our young men so that they will honor the profession, and the preliminary education is of the utmost importance. When we look around and find that almost every State has passed laws to protect the profession and the people from illegal practitioners, we realize that the profession of dentistry is one worthy of being a member of, and we should see that as far as we can control it, everyone shall be fit for the profession before he is allowed to enter it.

Dr. Fletcher was in accord with any movement intended to raise the standard of preliminary fitness for students. He said there was no excuse for anyone to try to enter the profession unless his mind had been so trained that he could reason and think of things in an abstract way. The mind was like the muscles of the body in its need of training before it could do any important work. He hoped the day would come when no student of a dental school would receive a diploma until he was examined by some board of undoubted qualification and disinterestedness, and his knowledge and fitness passed upon.

Dr. E. S. Talbot said that in the State of Illinois dental matters were in a bad way. Any man who wished to practice dentistry there could do so, and there was no one to prosecute him if he was not qualified. He spoke of the ease with which a dental college could be established in Chicago; said that some twenty-eight had already taken out charters. He did not know how many were now running, but thought six or eight. In some instances, the professors in these colleges are men who themselves never had a degree, but received them at the close of the course. The consequence is that no place in the world is so overrun with incompetent dentists as Chicago. He felt safe to say that over half his new patients for the

last five years were those who had their mouths mistreated by these incompetents. The legislature will not pass a satisfactory law, for the colleges do not want such a law. The thing to look forward to and to work for is to get a uniform law in every State. The laws passed by the States of Massachusetts, Minnesota, and New Jersey are good. A man going to any of these States to practice would have to pass an examination, and if he failed it would throw discredit on the institution from which he had graduated. If there were such a law in all the States it would enable us to regulate the colleges.

Dr. Carr said that three years ago students from two or three colleges had failed to pass the examination before the New York State board. Soon afterwards representatives from the faculties came to us and wanted to know just how high our standard was to be, so they would know what their students would have to be able to pass. It would soon bring a college into discredit if their students did not pass the examination of a fair and honorable State board of dental examiners.

Dr. Noble said that by the law of the District of Columbia a man who comes here to practice must have a diploma from a college that gives three full years of instruction.

Dr. Williams Donally said that he thought the only way to remedy the present evil of insufficient education among the dentists was for the profession, or some branch of the profession, to take hold of it. Probably the best way is by means of the State boards. Congress can not pass an interstate law regulating dentistry, but if we could get the State boards of the different States to work together the States might be got to do it. The colleges would see that their interests are favored by a strong law requiring a high educational qualification.

Dr. J. F. Thompson said the only way such a state of affairs as Dr. Talbot described as existing in Illinois could be remedied was by concerted action on the part of the best men in the profession. By this the status of dentistry could be placed on as high a plane there as in any other State. In Virginia they had an excellent law, which required an examination by the State board of everyone who desired to practice in the State, and the examination was of such a character that it made the students who had graduated from the colleges tremble when they returned to practice in Virginia. It took twenty-five years of effort to get this law passed, and he thought that the same effort would get the same result in Illinois.

Dr. W. H. Potter, of Boston, thought that the examining boards were not the best means to bring up the standard, but that the schools must do it. In Massachusetts the examining board is far more lax than the schools. The trouble is that the board is more or less influenced by politics. A good preliminary education is of the utmost importance. Without this foundation it is folly to expect a fine superstructure. The profession needs educated men; not only professionally educated, but generally educated.

Dr. Williams, in closing the discussion, said he was glad to have heard such a unanimous expression of the belief in the necessity of the preliminary examination. The knowledge of the principles of medicine and surgery was important for orists, but it was very discouraging for a teacher to try to get such knowledge into the head of a student who did not have a good preliminary knowledge and education. What should be exacted of the schools was the teaching of the principles of medicine and surgery, and impressing on the minds of the students the value of these principles in their application to the practice of oristry. Forty years or more ago it had been impossible for one to get an opportunity to study dentistry in a reputable office unless he agreed to take a full course of medicine. This, it seemed to him, was as it should be always.

EVIDENCES OF PREHISTORIC DENTISTRY IN CENTRAL AMERICA.

By R. R. ANDREWS, A. M., D. D. S., of Cambridge, Mass.

MR. PRESIDENT AND GENTLEMEN: Perhaps one of the most interesting exhibitions of prehistoric dental work that the world has ever known may be seen within a few months in the Central American exhibit of the Peabody Museum, at Cambridge, the result of a recent exploring expedition at Copan, Honduras. This collection is being fast put in order and will soon be on exhibition. It seems particularly fitting that a brief description of this work should be given at this meeting, the dental section of the first Pan-American Medical Congress, showing, as it does, the skill of the workmen of Central America, who did the work over a thousand years ago. In the report of Mr. M. H. Seville, one of the explorers, it is stated that the party found forests growing over the site of their exploration, that workmen had to cut down these forests, and then the excavations began. A very large temple was unearthed, and near this the homes of the former occupants. Tombs were found under the floors of what appeared to be the living rooms, and it would seem that these tombs were built in the foundation, before the house was built, for the purpose of burying the dead. The contents of some of these tombs, with the exception of the curious small ornaments that were found within, consisted of only particles of the former skeleton and only the crowns of the teeth covered by enamel. All the rest had turned to dust from age. In some of them the teeth, roots and all, were fairly perfect. Many of these teeth were found to be filed on the cutting surface, from the center toward the mesial surface, forming a notch as though a shoulder had been cut in the teeth. And this was quite deep, running one-third up the length of the crown. This was found also in the lateral incisors and cuspids, but not in the bicuspids or molars. It would seem that the teeth of the men were filed in this way, while the women's teeth were filed in three points, deeply filed and beautifully polished. In the teeth of the men, as a mark of distinction, perhaps, a hole was drilled and a piece of green jade inlaid. This piece was circular and beautifully polished, and inlaid in the hole that had been drilled or bored in the front surface of the enamel. These inlays varied from one-eighth to three-eighths of an inch in diameter. In one of the teeth, the left upper canine, there was a circular piece bored out of the enamel, making a hole three-sixteenths of an inch in diameter and one-sixteenth of an inch in depth. It has no setting, but there are traces of a dark-red cement material still adhering to the sides of the hole, and this material may have been hardened and used as an ornament instead of jade. These teeth are all more or less covered with a deposit of tartar, showing that after taking all the trouble to ornament them they were apparently never cleaned.

In this collection of jade inlays there are perhaps a dozen in perfect condition, and although they were put in over a thousand years ago, and with the rudest implements, the work would be considered a credit to the most skillful workman to-day, with all the modern appliances for this kind of work. I carefully examined these specimens with a magnifying glass, and the fitting was very perfect. In most of these the cement had kept the setting in place in the most perfect manner. In two or three of them the piece of green jade was loose, so that it and the cavity in which it fitted could be carefully examined, and one could see how perfectly one fitted in the other, only a little film of some kind of a white cement separating the tooth. In no cases could I find any trace of decay around the inlays, although some of them had been in place a long time during life, as is clearly shown by a thin film of tartar covering the surface of the enamel. Is not this the first record of an inlay, having been placed there over a thousand years ago?

With the description of one other specimen, I have done. This is by all means the most interesting of all these specimens from Copan. It is a left lateral supe-

rior incisor, made from some kind of a fine, dark stone, taken with other teeth which had inlays from one of the skulls found in a grave there, and Mr. Seville, who found it, assures me that it was taken from the socket of the left superior lateral incisor, where it had been implanted for over a thousand years. There were no bands or anything of the kind to hold it in place, but that it had been in place and in use is clearly shown by a considerable deposition of tartar upon it. But for its color it would be a very fair representation of a lateral incisor tooth, the root being smooth and rounded like the root of a tooth. I have no doubt that this is the earliest case of implantation on record. The entire collection from this exploring expedition in Central America is one of very rare beauty, and it would well repay a visit to the Peabody Museum in Cambridge.

THE DISCOVERY OF THE ANÆSTHETIC POWER OF ETHER.

By WILLIAM H. POTTER, D. M. D.

The progress of modern dentistry has been so rapid and its attainments so notable that there is danger that we, at least those of this generation, forget the important services rendered by those in our profession working nearly fifty years ago. A wonderful stimulus was given to surgery by the discovery of the anæsthetic power of ether in 1846. This discovery was made by a dentist, Dr. W. T. G. Morton, of Boston. Though others have claimed this discovery as their own, and have in many ways taken from Dr. Morton the honor due his most brilliant and useful work, there are few to-day who would deny his claim to having first established the fact that surgical anæsthesia could be produced and maintained by the use of sulphuric ether. In order to fully appreciate the honor which this discovery casts upon the dental profession it is well to review the circumstances under which it was made.

Fifty years ago the dental profession was largely occupied in furnishing good substitutes for the natural teeth. Vulcanite was not in use, and all dentures were mounted upon gold plates. On account of the pain accompanying the extraction of teeth, it was then the custom (at least in many cases) to leave roots in the mouth and fit plates over them. It was also the custom to use a very low-grade solder in attaching teeth to the plate. This solder, from its admixture of base metal, was unpleasant to the taste, and the method of fitting plates over remaining roots was uncleanly, and resulted in an ill-adjusted denture. In order to remedy these defects, Dr. Morton betook himself to careful study and experiment. He soon discovered the possibility of using a high-grade solder, and thus abolished the disagreeable effects connected with the solder heretofore in common use. But how to get rid of the roots which interfered with the fit of a plate was a question not so easily solved. It was Dr. Morton's experience that patients who had been accustomed to the insertion of plates without the removal of roots would not readily submit to their removal, even though it assured in the end a far more satisfactory result. It was the difficulty which Dr. Morton experienced in persuading his patients to submit to the pain of tooth extraction which incited him to find some way in which that pain could be abolished. His desire to perfect a process in mechanical dentistry, originated his efforts in behalf of anæsthesia. Doubtless, as time went on, the extended applicability of an anæsthetic agent was constantly before his mind. But it is interesting to note just what necessity started his inventive mind in courses destined to accomplish a widespread good.

Although complete surgical anæsthesia was unknown before Dr. Morton's discovery, a partial insensibility had in various ways been produced. The virtues of alcohol were known, and its power to diminish pain when given in extreme doses. Opium was often used in large quantities before a severe operation. Nitrous oxide

gas had been experimented with, but mainly in order to produce an interesting state of excitability. Hopes were entertained that it might be a reliable means of abolishing pain. Ether had for a long time been used by inhalation in cases of spasmodic asthma, chronic catarrh, whooping cough, and to relieve the effects produced by the accidental inhalation of chlorine gas. It had also been used, as had nitrous oxide gas, to produce exhilaration or intoxication. There was, however, no agent which could be relied upon even to greatly diminish the pain of surgical operations. Dr. Morton's zeal in the pursuit of anæsthesia soon led him to realize that he lacked the knowledge necessary for the investigation of a subject so intimately connected with medical science, and in order to fit himself for the work in hand he entered the Harvard medical school in the fall of 1844. It was in attendance upon the exercises of this school that he first met the men before whom he was destined soon to appear with his claim as the discoverer of surgical anæsthesia. In the wards of the Massachusetts General Hospital and at its operating theater Dr. Morton received renewed incentives for the work constantly in his mind. While the pain of dental operations needed relief, it was insignificant to that attending the operations of general surgery.

The history of Dr. Morton's experiments with ether is as follows: As early as July, 1844, at the suggestion of Dr. Charles T. Jackson, he used chloric ether locally to allay the pain of an aching tooth, and produced not only an alleviation of pain in the tooth, but a numbing of the surrounding parts. If ether could act locally as an anæsthetic, why could it not act generally and with profounder impressions? Such was the train of thought started in Dr. Morton's mind by the use of ether in the aching tooth. About this time Dr. Horace Wells, of Hartford, Conn., was experimenting with nitrous oxide gas, having become interested in its properties by the public exhibitions of Colton. In these exhibitions various stages of excitability and hallucination were produced which served to amuse a public audience. It occurred to Dr. Wells that nitrous oxide gas might be used to produce insensibility during tooth extraction. And he submitted to the influence of the gas while Dr. Riggs, of Hartford, Conn., extracted for him a tooth. The operation was declared to be without pain, and Dr. Wells believed that a new era in tooth extraction had arrived. His subsequent experiments, however, were unsatisfactory, and the idea of producing anæsthesia by nitrous oxide gas was abandoned for several years. But, though the experiments with nitrous oxide were unsatisfactory, yet they served to stimulate Dr. Morton in his efforts to produce a complete anæsthesia with ether.

His first experiments were with animals, a hen, a goldfish, and a pet spaniel having served as subjects. The effect of the drug was evident in these cases, a stupefaction and a certain degree of insensibility being produced. Dr. Morton also took ether himself, and produced a state of unconsciousness which seemed to offer immunity from pain. The best method of administering ether was an important question in Dr. Morton's mind, and a complicated apparatus, such as was used for nitrous oxide gas, was taken into consideration. In pursuing this detail of the subject, Dr. Morton sought the advice of his friends and acquaintances whose knowledge seemed likely to be of benefit. Among others he consulted his former instructor, Dr. Charles T. Jackson, a professor of chemistry in the Harvard medical school. Dr. Jackson gave him the benefit of his knowledge as to apparatus, and also gave him very valuable advice as to the necessity of using pure sulphuric ether, and as to where it could be obtained. On September 30, 1846, Dr. Morton administered ether to a patient in his office, and extracted a tooth without giving the slightest pain. The ether was administered on a handkerchief, and the result was so satisfactory that this operation can be considered as establishing the anæsthetic power of ether in a minor operation. In order to show the efficacy of ether in the full range of surgery, Dr. Morton applied to Dr. J. C. Warren, of the Massachusetts General Hospital, for permission to administer his

anæsthetic to a patient about to undergo a surgical operation. Dr. Warren entertained the proposition at once, and although not acquainted with the true nature of the anæsthetic, agreed to try to furnish an opportunity for putting it to proof. The readiness with which Dr. Warren granted the request of Dr. Morton is significant as showing that Dr. Morton had established for himself a reputation, not only in the profession, but as a student in the medical school. If this had not been the case, it is inconceivable that Dr. Warren should have so quickly lent his ear to a proposition which was at once bold and surrounded with danger.

The first surgical operation under ether was performed at the Massachusetts General Hospital by Dr. Warren, October 16, 1846. It consisted in the removal of a tumor from the underside of the lower jaw. The patient declared that he had experienced no pain, but only a sensation as if the part had been scraped with a blunt instrument. It was evidently a case of incomplete etherization, and this can not be wondered at when we consider the method of its administration. The inhaler consisted of a glass globe large enough to hold a fair-sized sponge. The globe had an opening at the top, through which the sponge was introduced and by which it was moistened with ether. To another opening at the side was attached a short tube which led to the patient's mouth. Subsequently a valve was introduced into the mouthpiece in order to regulate the supply of outside air.

Although the success of this notable etherization was not complete, it was still so pronounced as to convince all present that a useful discovery was at hand. No such removal of pain had ever before been accomplished. Though every sensation had not been removed, practical anæsthesia had been produced. But would ether suffice to prevent pain in a capital operation? This was a crucial test, and one which Dr. Morton was eager to try. It was not until the 7th of November, 1846, that an opportunity was given. On that day the thigh of Alice Mohan was amputated at the Massachusetts General Hospital without pain through the influence of ether, and its anæsthetic power was established to the complete satisfaction of the surgeons who witnessed the operation. A new era was thus ushered in by the advent of painless surgery.

It is not probable that the dental profession will ever again bring forth a discovery which will so advance the welfare of humanity as did Dr. Morton's. In his distinguished career several important points deserve attention. In the first place, it is to be noted that when Dr. Morton wished to make a decided advance in the dental profession he at once felt the need of a more thorough study of general medicine, and only by devoting himself heartily to its study was he able to arrive at the desired results; and to-day advance in our profession must be looked for along the same lines. We can not be true specialists without being thorough generalists, and in asserting that a thorough knowledge of medicine and surgery are necessary for a dentist, I do not mean a mere theoretical knowledge of these subjects. We should walk the hospitals and see the cases as did Dr. Morton. How else can we know what disease and its remedies really are? How else can we get the broad views which are necessary if we are to be wise and competent operators in the oral cavity? However much theoretical medicine the dental student of to-day may know, he does not know the cases as does the medical student. Is it not probable that one reason why Dr. Morton was so readily accorded the opportunity to test his new discovery in the Massachusetts General Hospital was his having been present there as a student? He was known by the surgeons as an earnest worker, and his efforts for the advancement of medical science were not despised. Because mere manipulative skill without a broad and thorough medical education can do so much in establishing a dental practice, there is danger that the profession will rest content with the training up of mere artisans, having just enough medical knowledge to save them from serious errors. It is from a union of broad medical education and

great manipulative skill that we are to expect notable advances in the dental profession. From constant work in the oral cavity the dentist acquires a mechanical skill which is beyond what the general surgeon can hope to attain in the same territory. Let thorough medical education be joined to the dentist's highly trained mechanical skill, and brilliant work can be looked for in many of the operations in the oral cavity which are now performed by the general surgeon. Our dental schools should have clinics for the practice of oral surgery, this to include not only operations on the teeth, but also on any and all the tissues in the oral cavity. I do not argue that every dentist should practice the full range of oral surgery, but I do claim that every dentist should have sufficient medical instruction to readily adopt the more enlarged sphere of action should his tastes and opportunity favor such work.

Another teaching from Dr. Morton's life is that mechanical dentistry should not be despised. His reputation was first gained as a maker of artificial plates and as a skillful adjuster of artificial vela and appliances for restoring impaired facial members. His skill in the latter direction gave him much reputation, inasmuch as the work was of a more unusual nature than that of making plates and required a greater degree of manipulative skill. Who would imagine that from a desire to perfect the details of an artificial plate experiments would be undertaken which would result in the complete removal of pain from surgical operations? Yet such was the case, and the dental laboratory must evermore be honored as the birthplace of an idea which ranks with the greatest discoveries of the age. Although Dr. Morton's claim as the discoverer of the anæsthetic power of ether is now quite generally allowed, there were times when rival claimants tried to take from him the honor which should have been his. Dr. Morton had little uninterrupted satisfaction or substantial profit to reward his work, but this was largely due to the mistake which he made when he decided to patent his discovery. Had the discovery at the first been given to the public, its reception by the medical profession would have been with much less suspicion and with much greater honor.

Such were the apparent profits to be realized from the discovery that the granting of a patent conveying exclusive right to the discoverer stirred up endless controversy as to originality and resulted in great financial loss. From this experience of Dr. Morton can be learned the final lesson of this paper. Whatever important inventions may originate in our minds, let us never take them to the Patent Office. Let it be the pride of our profession to give our best endeavors freely for the good of humanity, knowing that they will receive in the end a just reward.

DISCUSSION.

H. B. Noble said, while listening to the paper and remembering the inaugural address by Dr. Shepard before the Columbian Dental Congress, it occurred to him to wonder why two such papers, reviewing an old issue which he thought had been entirely and satisfactorily settled long ago, should have been written. He said that from a close personal acquaintance with Dr. Morton and the knowledge he had gained from his brother, Dr. Lester Noble, who was a student (and at present in the Massachusetts General Hospital) at the time Morton administered the ether for Dr. Warren's operation, and a good general knowledge of all that had been said and written upon the subject, he was convinced that while Morton deserved the credit of introducing ether anæsthesia into dental and surgical practice, his claim to having discovered its anæsthetic qualities was not founded upon the truth. The fact that he included Dr. Jackson with himself as a coinventor proved that he could not claim to be the sole inventor.

Dr. Potter said that the credit for the original invention of many very valuable ideas was and always would be in dispute, but he thought the undisputed fact that Morton made the use of ether known and introduced and pushed its use in dentistry and surgery entitled him to great credit. We know that ether had been made previous to his use of it, but it had never been used as an anæsthetic in surgical operations.

STATEMENT OF SOME FACTS IN REGARD TO THE ORIGIN OF THE PRACTICAL APPLICATION OF ANÆSTHESIA IN SURGERY.

By JACOB L. WILLIAMS, M. D., of Boston, Mass.

That sulphuric ether was repeatedly used as an anæsthetic by Dr. Long, of Athens, Ga., in his surgical practice about 1840, seems indisputable from the reliable evidence collected and published by the late Dr. Marion Sims, of New York, but a few years ago. The fact that Dr. Long did not publish its use to the world does not affect its priority. Next comes, about four or five years later, the experimental discovery and practical application, by Dr. Wells, of Hartford, Conn., of the anæsthetic effects of nitrous oxide gas. Then, some facts (known to me, as I was behind the scenes): About a year later Dr. Morton, remembering vaguely that Dr. Wells had faith in anæsthesia by inhalation of something, applied to Dr. Jackson, who informed him that from his (Dr. Jackson's) personal experience sulphuric ether had relieved his suffering from the accidental breathing of chlorine gas, adding a caution in regard to its use. Dr. Morton finding Dr. Jackson's information correct in regard to the "lethal" effects of sulphuric ether, by persuasion induced Dr. Jackson to unite with him in procuring a patent to control its use. Dr. Jackson's medical friends reminding him of the breach of ethics in getting such a patent, he withdrew from the patent. It was then that Dr. Morton claimed the sole discovery of ether anæsthesia, and wishing to have some respectable backing, he went to Dr. John C. Warren, the head of the surgical staff of the Massachusetts General Hospital, and said in his persuasive way that he had discovered a "compound," he called "letheon," that would prevent pains in surgical operations, and would be pleased to show its effect on some hospital patient. Dr. Warren consented to the trial, which proved successful, but he, with the rest of the staff, declined to indorse or adopt it unless they knew what it actually was. Of course Dr. Morton had to tell them that it was sulphuric ether. They then began its use, and it was their indorsement which gave it the successful start in the surgical world, without which it is very probable it might have fallen into the list of empirical fancies.

The summing up of these facts seems like this: Dr. Long's successful private practice, followed after several years by Dr. Wells's success, which his diffident nature hindered him from pushing to notoriety, then Dr. Jackson's information to Dr. Morton, which he, Morton, followed out and brought to the notice of the surgical staff of the Massachusetts General Hospital. These surgeons, having eliminated its elements of quackery, tried the substance effectually and with their substantial indorsement gave it to the world. To that indorsement, it surely seems, is due the permanent consideration that anæsthesia has since received.

DISCUSSION.

Dr. Taft said he had been personally acquainted with Morton, had seen him administer ether frequently, and usually successfully. Had also made himself familiar with all the literature of the subject, and that the statement of Drs. Williams and Donnally agreed with what was generally accepted as truth at the time.

PRINCIPLES UNDERLYING THE REGULATION OF THE HUMAN TEETH.

Dr. E. A. BOGUE, of New York.

In the great majority of cases irregularities in the position of teeth arise from the dental arch being too small. The causes which produce this diminution of size are often obscure. We say heredity; we see the roots of pulpless deciduous teeth remaining too long in their places and deflecting the crowns of permanent teeth away from their proper positions. This deflection is generally, though not always, inward toward the center of the mouth. We guess that the failure to masticate properly may in some way, as yet unknown to us, produce these results, as we see them most frequently in those classes where the food is carefully prepared by cooking and made fine for eating. But be the causes what they may, the effects are certainly present, and the problem before us is so to correct irregularities in the position of the teeth as to produce the nearest approach to the normal arch which will, through its own perfections, remain where it is put. It is only through obedience to the laws governing the growth and development of the child that we can hope to obtain permanence in our results. What, then, are these laws, obedience to which means success and transgression failure? The first one to be borne in mind is that the child continues to grow up to 18 years of age or later, according to the age at which the wisdom teeth erupt. Eighteen is mentioned because that is the age at which the wisdom teeth generally appear, and yet several cases have lately come to my knowledge in which practitioners have advised the removal of the retaining fixtures which maintained an expanded arch before even the cuspid teeth were fully erupted, thus losing all that had been gained by months of previous effort. The second law is that the crowns of the permanent teeth that are packed away in the jaws of the child of 6 years of age, awaiting their time of eruption, are as large as they ever will be. A fact in connection with this law is that at this age these crowns have no roots. Another fact is that the central incisors lie outside of and anterior to the lateral incisors, while the cuspids which develop much later are almost alongside of the central incisors, being at the same time much higher up in the alveolus. As the roots develop the crowns push through the gum, and at this period a very slight obstacle is enough to deflect these crowns from the position which they should normally occupy into abnormal, or as we say, irregular positions. The normal development is of the lower central incisors first, the upper central incisors next, these latter often standing quite apart until the lateral incisors make their appearance, causing a slight approximation. At from 12 to 14 years of age the cuspids make their appearance, the lower ones some months, oftentimes a year, previous to the upper. These four cuspids, when fully grown, have the longest roots of any of the teeth and are the firmest in their positions; so firm, indeed, that if teeth posterior to them are extracted the remaining back teeth move forward toward the cuspids. If any of the four incisors are extracted the remaining incisors drop back toward the cuspids, but the cuspids remain more nearly stationary than any of the teeth in the mouth, and this through life. This is the third law that we need to bear in mind. It will perhaps be well in passing to recall the fact that the cuspid teeth are, in the lower animals, especially the carnivoræ, the prehensile teeth. Hence it was that they should be the strongest and firmest teeth in the mouth and the longest to endure; otherwise these animals could neither catch nor hold the prey upon which their existence depends. A fourth law to be borne in mind is that the lower molars incline inward toward the tongue, while the upper molars incline outward toward the cheek. The lower molars develop first, the upper molars afterwards, being directed in their course, if normally developed, by their contact with

the cusps of the lower molars. This results in the upper molars and bicuspids sitting astride of the outer row of cusps of the corresponding lower teeth. Ignorance or neglect of this law not infrequently has caused the extraction of a bicuspid or a molar during the period of development, the result of which is beautifully illustrated in two cases which I herewith present. In one of these cases the extraction of a lower bicuspid took place. In the other, non-development of the corresponding tooth on the other side of the mouth brought about practically the same result. It will be seen that the failure of the molars to properly interlock the cusps as they developed incapacitated the left side of the mouth, in the case of non-development, completely, so that the patient never masticated on that side, and the development of the facial muscles was hindered, irregularity of the lateral incisors was produced, and thus the left side of the face of an otherwise pretty woman was sufficiently unlike the right for her to apply for professional assistance, although at that time she was totally unaware of the cause of the defect or of the fact that mastication had never been performed on the defective side of the mouth. A sixth law is that the lower incisors normally lean forward, forming a low arch, with the cuspids acting as abutments, while the upper incisors, overlapping the lower, are drawn inward continually by the action of the upper lip and normally form their arch by resting against the outer edges of the lower incisors. Hence we see in the great majority of cases that the regularity of the upper incisors, which are so apparent, is controlled by the position of the lower incisors, which are generally scarcely visible, so that if the lower incisors and cuspids are regular, the upper ones are sure to be if they close outside the lower. This is true whether the upper teeth stand closely enough together to touch one another or not. This position is illustrated by the drawing of the jaws of a savage, which I herewith present, showing the upper incisors perfectly regular, notwithstanding the space existing between the lateral incisors and the cuspids.

Allow me, in closing, to recapitulate these six laws: (1) The child continues to grow up to 18 years, or the time for the development of the wisdom teeth. (2) The crowns of permanent teeth are as large in circumference at 6 years of age as they ever will be, and they are packed away in the alveolus with regular irregularity, the central incisors lying in front of the laterals and the cuspids almost over them. (3) The cuspids are the firmest and least movable of all the teeth in the mouth, so that all the other teeth incline toward them. (4) The lower molars incline inward and the upper molars outward. (5) Each class of lower teeth develops before the corresponding upper teeth, and thus guides, or ought to guide, the upper teeth into a right position. (6) The lower incisors normally lean forward to form an arch with the cuspids, and so support the arch of upper incisors, which, closing outside of the lower ones, are constantly drawn toward them by the action of the lips.

DISCUSSION.

Dr. E. S. Talbot said that when irregularities of the teeth were caused by the fact that the teeth were too large for the jaws the reason of the smallness of the jaws could generally be ascribed; first, to heredity, where the jaw seemed to be derived from one parent and the teeth from the other; second, to a neurotic temperament in one or the other of the parents. The child inherits this neurotic condition and, because of the faulty nutrition consequent upon it, at the age of 6 or 7 years the jaw ceases to grow. We all know that the brain does not increase in bulk much, if any, after this time, and in these cases the jaw ceases to grow at the same time. The third cause is constitutional disease in the child, such as scarlet or other fever. The interruption in nutrition caused by such sickness will cause the jawbones to cease growth. In regard to the teeth standing

inward, as shown in the illustration, this is because, while the lower jaw is developed normally, the development of the upper jaw was retarded by some cause and the teeth as they came through were crowded out of line. It is not true, as the paper says, that a man's growth is completed by the eighteenth year. Growth usually continues until the twenty-second and frequently till the twenty-sixth or twenty-seventh year, and in exceptional cases till as late as the thirty-sixth year. He spoke of the regulating systems of Drs. Farrar, Patrick, and Angle, condemning them because they used the molar teeth as anchorage to move the cuspids back to fill up the space made by extracting the first molar. He said that the cuspid has such a long root and is so firmly fixed that the posterior teeth will move forward instead of the cuspid backward. He described a case of a gentleman who was at the clinics in Chicago at the Columbian Dental Congress to have the cuspid and bicuspid implanted. Upon preparing for the operation the bicuspid was found unerupted and the implantation had to be abandoned. Subsequently an attempt had been made to move the anterior teeth, which were badly crowded and projected from their proper position, back to fill the vacant space and into their proper position. The molars were used as points of resistance, and the consequence of the force applied had been to move them quite inside the arch; so they did not touch the corresponding teeth in the upper jaw. This is an instance showing the futility of trying to move the cuspid by anchoring on the molars. The only sure way to accomplish the movement of these teeth is to use the back of the head for resistance.

Dr. William Carr asked Dr. Talbot if adenoid tumors, nasal polypi, and other growths which caused mouth breathing were the cause of irregularities in the teeth.

Dr. Talbot answered that these diseases came together and did not sustain the relation of cause and effect one to the other, except that anything which caused mouth breathing by bringing about the habitually open mouth would, by destroying the effect of support by the lower teeth upon the upper, allow the upper teeth and alveoli to grow down and the teeth to protrude.

Dr. M. H. Fletcher said that one fact usually left out of discussions on the cause of irregularities of the teeth is that bone will be absorbed by pressure of the teeth if force is applied to move it, thus removing the bone from in front of the tooth, and that will grow around it to hold it firmly in its new position. From this it follows that in cases of overcrowded teeth, if they are treated in time, the shape and size of the jaw can be corrected by bringing pressure to bear upon the teeth.

Dr. Carr asked Dr. Talbot if mastication had an effect upon the development and shape of the jaw and the regularity of the teeth.

Dr. Talbot said yes; that both the lower and upper jaw were developed by use and friction, and that if children were taught to masticate their food properly the jaws would be better developed.

Dr. J. Taft asked Dr. Talbot if he had said that the jaws were fully grown at the age of 6 or 7 years.

Dr. Talbot answered that he had said that in children who had inherited a neurotic temperament they were; not in the case of normally healthy children.

Dr. Taft spoke of the influence of properly masticating the food upon the growth of the jaws and the general health of the system. He insisted upon the great importance of teaching the parents of children the necessity of using the teeth. He said too much of the food given to children is prepared so as to give no exercise to the jaws, and that not only do irregularities and lessened development of the bones of the face occur in consequence of this, but the structure of the teeth is less dense than it would be if the children should use their teeth habitually in masticating hard substances. To teach people to use their teeth, and thus prevent irreg-

ularities, would be better service than to correct irregularities. This lack of properly masticating the food is much more general than is usually supposed, and should receive more attention. The teeth, as we know, do not all erupt at once, and if they are used those which are erupted will by reason of the shape of the cusps bring the latter ones into proper occlusion. This emphasizes the necessity of early teaching the facts in regard to properly masticating food.

Dr. S. B. Brown said that in his town, Fort Wayne, Ind., they had had a teacher who was so impressed with the fact that the jaws and teeth needed exercise to insure their well-being that he advised the parents to have the children eat parched corn.

Dr. Taft said that it was easy to see how the proper use would increase the size and strength of both jaws and the teeth. The act of masticating caused pressure which would expel the blood from the capillaries acted upon, new blood would flow in, carrying new material, which would enlarge and strengthen the parts. Thus the bones would be larger and stronger, the teeth more dense, and the gums firmer in structure and in their hold upon the teeth. He said that tobacco chewers usually had gums which extended well down upon the teeth, of good color and healthy. On account of the food they use the jaws of aborigines are usually broad and strong and the teeth large and good.

Dr. Finlay Hunt spoke of a report made by Dr. Winder of the result of the examination of about 1,000 crania of the Indians in the northwestern part of the United States. About one fourth of these skulls had lower jaws; thus they contained in all about 20,000 teeth. In all these there were less than 50 showing any trace of caries. In one cranium, belonging to a half-breed, however, there was decay in both upper and lower jaws. In Dr. Hunt's view, the preservation of the teeth depended upon the preservation of the whole physical system. Civilization, by cultivation of the mind and brain, tends to expand the upper head and contract the lower part. Disregard of the laws governing the development of the whole body was the cause of the lack of development of the jaws. At birth the maxillæ of a child are almost perfect semicircles; as the teeth erupt the jaws elongate; when there are 20 teeth the jaws are full. They extend clear back to the articulation of the jaw, and after this the jaw elongates enough to receive three more on each side of each jaw. The jaw is elongated and alveolus is formed to contain the whole 32 teeth of the complete denture. The constant pressure of the tongue upon the lower teeth tends to expand the lower jaw, and as these teeth are erupted first they have a controlling influence upon the upper teeth as they appear and regulate their position. All the muscles of the face which come into contact with the teeth tend to determine their position.

HYGIENE OF THE MOUTH.

By CHARLES E. FRANCIS, D.D.S., M.D.S., of New York.

The specialty which we have chosen for our field of professional practice is one fraught with great responsibilities, demanding of its members a very considerable degree of intelligence, good judgment, skill, and faithful manipulation if its benefits to the human family are to be fully realized. Perhaps no other branch of medicine can reach and benefit mankind to a greater extent than the department of dentistry. The health, comfort, happiness, and length of life of members of all communities depend greatly upon the condition of their organs of mastication. If neglected, decayed, and broken they are unfit for the proper comminution of food for nourishing the animal tissues. Imperfectly prepared pabulum forced into the stomach overtaxes and irritates this much-abused receptacle, deranging its

function, causing indigestion and attendant evils to which so many human mortals are subjected. And furthermore, when the teeth become diseased and painful they wear heavily upon the nerve forces, cause loss of restful sleep, and unfit their unfortunate possessors for the duties of the day. They also taint the breath, corrupt oral secretions, impair speech, and often make life well nigh miserable. And where the dental arches are contracted, the teeth irregular and crowded out of proper position, the face is bereft of its natural rounded contour and the features become more or less distorted. This, together with surfaces of the teeth clouded with dark stains and loaded with offensive accumulations, are often a source of dire mortification to their possessors, and objects unsightly and repulsive to whoever beholds them.

To allay pain occasioned by a diseased condition of the calcific organs within the oral cavity and restore them as far as possible to a state of health and usefulness is one of the chief duties of the dental surgeon. To remove such as are beyond the power of restoration and are a source of continued irritation; to insert artificial substitutes for filling vacant spaces caused by these removals, constitutes also a large share of the dentist's occupation. For the performance of these manifold and often complicated duties the student of dentistry is trained and fitted in our excellent institutions for dental instruction. For the better fulfillment of these duties, and to keep alive and fresh all matters pertaining to practice, dental societies have been organized and are in active existence all over the country, where members of our specialty from time to time convene to consider and discuss all matters of professional interest. And every month in the year there comes to us our favorite journals exhibiting pages teeming with writings of earnest workers, who thus impart whatever new they have discovered or have gathered by experience, observation, or experiment; and so do the members of our fraternity endeavor to increase their usefulness and to render better service to communities that look to them for such attentions as they need. But however earnest may be the efforts of the dentist to benefit his patients in the way of repairing, restoring, or otherwise treating broken or diseased dentures, and however satisfactory may appear the immediate results of his manipulations, he can not be sure that his excellent skilled labor will withstand the encroachments of time or his fond hopes for the durability of his operations be fully realized.

Diseases of the teeth and gums are, as a rule, due to habitual carelessness or a neglect to give them such attention as they need. Everybody must or should know that decalcification of the lime salts in the tooth structure is caused by a chemical action of acidulated accumulations remaining too long in contact with the teeth, and that diseases of the gums are, as a rule, occasioned by collections of food and salivary calculus, which are permitted to gather about their cervical borders and fill the dental interstices. The mucous membrane, from this unwelcome intrusion, becomes irritated and naturally recedes. Collections of calculus follow and become attached to the denuded surfaces; the alveolar territory is invaded and absorption induced, and where any idiopathic tendency to socket disease exists this disagreeable malady is sure to be developed.

According to the old aphorism, that "like causes produce like results," conditions within the buccal cavity which are productive of mischief, if allowed to continue or afterwards exist, are almost certain to witness a reproduction of similar forms of mischief. If, then, our patients expect to be permanently benefited by operations on their teeth, it is essential that they do their part in efforts to make them lasting. As "prevention is better than cure," the theory of prevention is a matter worthy their earnest consideration. In order to secure good dentures care is requisite at an early period of life. The deciduous teeth should be retained in the mouth and kept in a healthy condition until supplanted by their more durable successors, extraction being resorted to only in cases of extreme necessity.

Premature loss of the deciduous teeth means not only a loss of their useful services, but in a measure it interrupts or checks the full or perfect development of the dental arches. The permanent teeth also need frequent examination during the period of their eruption and to be kept free from stains or extraneous collections. Any suggestion of caries or decalcification should receive immediate attention, and all suspicious points be examined with the utmost care. Finely pointed searching instruments and magnifying glasses are essential for this purpose, and waxed floss silk passed between the teeth will also aid in disclosing defects. Cases of irregularity should invariably be corrected, certainly as much so as possible, in order that well-formed arches and perfect articulations may be secured; and when in regular order the daily task of cleansing them is much less difficult.

It has been said that "cleanliness is next to Godliness," and nowhere can this excellent law be observed to greater advantage than within the precincts of the oral cavity. Our patients should be made to understand the importance of giving due consideration to their organs of mastication, and instructions or advice on the part of the dentist impressively imparted. Our patients should also know the advantages they gain by having their teeth examined at frequent intervals—at least twice a year. I have reason to believe that many of our fraternity are remiss in this matter, and even where they give advice or warning their words are not sufficiently emphatic or comprehensive to become effective. People should be taught the use of a toothbrush and how to manipulate it to the best advantage, and the proper time for using it. They should also be instructed regarding the use of floss silk, toothpicks, dentifrices, etc., and the benefits to be derived from frequent and thorough rinsings of the mouth with water. Antiseptic mouth washes have also their benefits, especially where the gums are congested and receding from the teeth. The disgusting disease known as "pyorrhœa alveolaris" may often be held in check, and perhaps prevented, if proper attention is given in the way of keeping the teeth in good condition.

To the dentist who does all in his power to perfect his operations, it is certainly disheartening when at some subsequent period he discovers that his labors have availed but little. The best impacted fillings, if constantly menaced by agents of decalcification, are likely to become undermined and prove valueless. The dentist may cleanse the teeth of his patient with the greatest degree of thoroughness, treat diseased gums and alveolar borders until restored to health, and dismiss the patient with the feeling that the teeth of the latter are in perfect order, yet what material benefit may be expected if they are again permitted to become neglected and coated with vicious accumulations? It is a lamentable fact that so many individuals are habitually and inexcusably careless in this respect. Comparatively few give them such attention as they need, and many give them little or no care whatever, and perhaps never visit a dentist until some unbearable pain drives them thither for relief. Even then some of them seem to entertain the idea that their half-ruined dentures can be made almost as perfect as ever, and so insured from giving annoyance for all future time without further care or trouble on their part. So far as the dentist is concerned, he can never be too thorough in his examinations or in his operations of cleansing. Either is quite essential. Nor can the dentist be too particular in imparting hygienic instructions to his patients. Anticipation, or timely attention, and prevention constitute strong points in securing the preservation of the natural teeth.

DEVELOPMENT OF THE VAULT; HISTORY OF DEFORMED VAULTS.

By EUGENE S. TALBOT, M. D., D. D. S., of Chicago, Ill.

It is a singular fact that depressed palates and irregularities of the teeth were first observed and described by medical men. Langdon Down called the attention of the medical profession to the fact that high vaults, as well as irregular-shaped jaws, were very common among idiots and congenital imbeciles. In a paper read before the Odontological Society of Great Britain he says, among other things, speaking of idiots in the Earlswood Asylum:

Of the most significant value, however, is the condition of the palate. I have made a very large number of careful measurements of the mouths of the congenitally feeble-minded and of intelligent persons of the same age, with the result of indicating, with some few exceptions, a markedly diminished width between the posterior bicuspids of the two sides. One result, or rather one accompaniment of this narrowing, is the inordinate vaulting of the palate. The palate assumes a roof-like form. The vaulting is not simply apparent from the approximation of the two sides; it is absolute, the line of juncture between the palatal bone occupying a higher plane. Often there is an antero-posterior sulcus corresponding to the line of approximation of the two bones. An appeal to the condition of the mouth is an important aid in determining whether the lesion on which the mental weakness depends is of intra-uterine or post-uterine origin. In the event of the mouth being abnormal it indicates a congenital origin, while if the mouth is well formed and the teeth are in a healthy condition it would lead to the opinion that the calamity had occurred subsequently to embryonic life.

Indeed, he went so far as to state that these conditions when observed in young children were pathognomonic of idiocy. Upon further observation, however, it was found that many idiots and feeble-minded individuals possessed low, narrow vaults. It was also observed that many sane persons possessed high vaults and V and saddle shaped arches. My own studies prior to the year 1887 not only show high and contracted arches among sane individuals as well as idiots, but that they are also very frequently observed among the deaf, dumb, blind, insane, criminals, drunkards, extreme tobacco users, extreme egotists, in neurotics and degenerates generally. It will be noticed, therefore, that no particular class of individuals is exempt from these deformities. The frequency with which they are observed in each class will be studied later. The fact that the high vault and contracted arch are not confined to any one class of individuals would prove conclusively that the high vault is not due to mental weakness. Dr. Clay Shaw (Journal of Mental Science, July, 1876) made extensive observations and accurate measurements of the mouths of idiots, and decided that "there is no necessary connection between a high palate and the degree of mental capacity of the individual." These deformities are never observed in connection with the first set of teeth. (I shall show later that they always form between the eighth and twelfth year.) The fact that they are developed in utero, or are of congenital origin, or a forerunner of idiocy, as advanced by Dr. Down, is entirely out of the question. Dr. Clay Shaw believed that a high palate is invariably associated with narrow pterygoid width and a narrow skull; but this theory is of little value. By a close examination of the vaults of the dolichocephalic heads it will be seen that such is not the case, but that they are also to be seen among the brachycephalic and mesocephalic heads.

DESCRIPTION OF THE VAULT.

The roof of the mouth has received different names from different authors. One speaks of it as the arch, another the dome, still a third the palate. The word arch, although used in its proper place, is so often liable to be confounded with the dental arch that one is apt to become confused. Thus we frequently read of the V or saddle shaped arch, and we are quite unable to decide whether the writer intended

to refer to the dental arch or the roof of the mouth. The author has in former papers used the term vault to distinguish it from the dental arch, and we shall therefore continue its use in the present paper. The vault of the mouth is made up of the hard palate, the soft palate, and the alveolar process. The hard palate consists of two horizontal plates of bone extending from the superior maxillary bone upon either side and uniting at the median line, and from the anterior alveolar process in front it extends back on an average of 2 inches, when it unites with the soft palate. The hard palate is composed of six distinct parts, two incisive bones, two palate plates of the superior maxillæ, and two horizontal plates of the palate bones. The incisive bones, however, become so firmly united to the maxillary plate of bone so early in life that the suture becomes obliterated. The period of ossification of the median suture varies in different individuals, sometimes as early as the third and fourth years, and again as late as the fifteenth and sixteenth years. The author, in widening the arch by means of a jackscrew, has opened the suture of the medium line in 14 different cases in children from 12 to 16 years of age. This was accomplished by very little pressure, showing that union had not taken place. As a whole, the hard palate may be described as a horizontal partition or floor separating the nasal cavity from the mouth. The anterior part of the palate bone unites and becomes a part of the alveolar process. The upper surface of the hard palate joins the floor of the nasal passages, which are divided in the center by the union of the vomer. This bone, which is quite thin at its middle portion and cartilaginous at the anterior part, begins to thicken as it reaches the floor of the nose, at which place it gradually produces a smooth appearance, dividing the nostril into two rounded arches. Upon the palatal surface it is very uneven. Along the median line we frequently find a rough ridge of bone resembling a section of rope, running its entire length, about the size of a slate pencil. Such a condition is frequently observed in Peruvian skulls. Out of 228 examined at the Peabody Museum, Harvard College, 16 had this peculiar appearance. In more modern skulls we find knots or rough lumps of bone at intervals along the suture. Again, we will observe a thick band of bone, from 0.25 to 0.50 of an inch in width, extending part way or the entire length of the suture. This thickness or prominence commences at the alveolar border, and becomes the widest at the second bicuspid and, first permanent molar, where it gradually narrows to a mere point at a line drawn across the vault at the posterior surface of the second molar. The hard palate varies in thickness in different localities and differs in thickness in different individuals. Around the edge, where it unites with the maxillary bone and alveolar process, it is quite thick, and also at the median line, while about midway between these two parts the bone is as thin as tissue paper. I have also observed it from 0.12 to 0.18 of an inch in thickness. At the median line and just back of the incisors we find a fossa, which transmits the anterior palatine vessels and the naso-palatine nerves. At the posterior surface, upon either side, is a groove and an opening for the transmittance of the posterior palatine vessels and nerves. Both the upper and lower surfaces of the hard palate are covered with mucous membrane, which extends backward and unites to form the soft palate. Between the two folds of mucous membrane are muscular fibers for the purpose of moving the soft palate in different directions. The shape and length of the soft palate depend upon the distance between the œsophagus and the edge of the hard palate. If the head of the individual is dolichocephalic, or long, the soft palate will curve slowly backward, thus producing quite a long space between the incisor teeth and the uvula. On the other hand, if the person possesses a brachycephalic, or short head, the soft palate will curve abruptly, thus allowing only a short distance in the vault of the mouth. I have observed mouths where the head was so short from front to back that the soft palate descended nearly straight down without the slightest curve.

The alveolar process has already been described. The above description of the anatomy of the vault is quite sufficient for the purpose of the student. Should he require further details, refer to the standard text-books. The vault, taken as a whole, presents different shapes in different individuals.

NORMAL DEVELOPMENT OF THE ROOF OF THE VAULT.

If we examine the mouth of a child at the fourth or fifth year we find a well-developed jaw. The curves are all graceful in outline, and the contour of the dental arch is well formed. This could hardly be otherwise, for the reason that the jaw is growing rapidly for the purpose of accommodating the permanent teeth, and the circle of the alveolar process is larger than that of the teeth. Spaces exist between the teeth, and therefore crowding can not take place. We could not expect to find two vaults alike in height, width, or contour, although each is normal in itself. In the development of the jaws we have two structures, the hard, dense bone of the maxilla and hard palate, and the soft, spongy bone, the alveolar process. The maxillary bones develop and unite at the median line. The contour of the top of the vault is now established. It is held in position on the sides by the walls of the antrum, supported by the malar process and by the anterior alveolar process and maxillary bone. In this manner the vault is held in its natural position. The maxillary bones, like all the other bones of the head, develop in every direction in a general way until the growth is established. Between the ages of 4, when all the temporary teeth are in place, and 12 and 14 years, when all the permanent teeth are in position, great changes take place in the shape of the jaw.

In the face of a girl 3 years of age all the bones, together with those of the cranium, are undeveloped. The bridge of the nose is sunken, the upper lip is short, as well as the distance from the lower lip to the chin. In same girl at 13, while the width from cheek to cheek has not changed to any great extent, the length of the face from the chin to the top of the head is very marked. No part of the face has changed more than the lower part from the nose down. This change is due partly to the change in the angle of the lower jaw and partly to the development downward of the superior alveolar process. In young life the lower jaw presents an obtuse angle; this gradually changes, until at middle life it assumes a right angle. In order that the alveolar process and teeth may compensate for this change as the second set comes into position, the alveolar process lengthens with the eruption of the teeth. This is proved by the location of the mental foramen, which is situated at the superior border of the lower jaw early in life, and at middle life just midway between the upper and lower border of the bone. The same changes take place in the upper jaw. This is quite noticeable on the sides of the alveolar process at the roots of the first permanent molar soon after it has erupted. Upon examination we shall observe what seems to be a depression, but by careful examination we find that it is a lengthening of the alveolar process. When the crowns of the bicuspids are ready to advance and absorption of the roots of the temporary molars takes place, there is some irritation in the alveolar process. The first permanent molar coming into position advances farther than the line of articulation of the temporary molars, and the pressure of the jaws rests upon the first permanent molars. This fact, together with the irritation already mentioned, has a tendency to lengthen the alveolar process, so that when the bicuspids come into place there is a difference in the height of the vault. There are plenty of illustrations to show this development of the alveolar process, and every practitioner of dentistry has observed it.

One of the most common illustrations is that when the molar teeth upon the lower jaw have been extracted the molars upon the upper jaw (for want of an antagonist) drop down by the lengthening of the alveolar process. In this manner we obtain the difference in the length of the face. In those cases where the vault is very high the alveolar process is always very long and thin.

The depth of vault is also governed by the angle of the jaw. Thus, if from inherited constitutional disease, such as consumption, syphilis, etc., arrest of development of the maxillæ should ensue, the angle would not change from an obtuse to a right angle. It will be noticed that when the mouth is opened the anterior part has to travel a greater distance than the posterior part, hence either the anterior inferior alveolar process will elongate so that the lower incisor will articulate with the upper, or the anterior superior alveolar process will elongate to meet the lower incisor and bicuspid. Occasionally this will take place in both jaws. In either case the superior alveolar process becomes long and thin and the vault is quite high. In cases of arrest of development of the bones of the nose and when adenoid growths renders it impossible for the child to breathe through the nose; mouth breathing becomes a necessity, the jaws are separated, and the teeth not having a resting place the alveolar process elongates and a high vault is almost always noticed. This is the reason why imbeciles and all degenerates who keep the mouth open, as a rule, have high vaults. On the other hand, we occasionally notice the jaws brought closely together. This is due (1) to short rami; (2) to right angles of the rami to the body of the jaw; (3) to arrest of development of the alveolar process, and (4) to teeth with short crowns or teeth not fully erupted. In such cases the vault is low, the alveolar process thick, and usually the lower jaw is quite broad; the lips pout, the face is short and broad. Frequently the upper jaw is arrested in its development; the muscles of mastication are very set and rigid. The height of the vault, then, is not due to the roof's being pushed or pulled up by a pressure exerted through the vomer by the development of the sphenoid bone, nor does the shape of the base of the skull in any way affect it, as I have already explained. The height is due entirely to a growth downward of the alveolar process and teeth. The extent of the development of the alveolar process depends upon nature's becoming satisfied with her architectural figures, and harmonizing the jaws, alveolar process, and length of teeth. That the distance in height is changed from a child to a person of middle life is demonstrated by the following figures: Thus in 317 children under 5 years of age, before the development of the first permanent molar and alveolar process, the lowest vault measured 0.17, the highest 0.62, with an average of 0.42. If now we notice the height of vaults in children at different ages, we find, with two exceptions, a gradual advance in the height of the vaults, until in 4,614 adult vaults we have lowest 0.21, highest 0.84, with an average of 0.58. It will therefore be observed that the height of vault develops about 0.33 to 0.25 in depth after the permanent teeth commence to erupt. In 908 measurements of the vaults of ancient and modern Romans, Peruvians, Sandwich Islanders, Mound Builders, American Indians, Negroes, etc., the minimum height of vault was 0.25, while the maximum height was 0.88; average 0.53. By comparing these figures with those obtained from the examination of modern individuals, the lowest vault of the ancients is a little higher (0.04) than of the moderns, and the highest a little higher (0.04). The average, however, is a little lower than in the modern vaults of 0.05, thus showing that the ancient and pure races of individuals possess more uniform and lower vaults than modern. We would conclude, therefore, that the height of the vault depends upon the length of the face from the chin to the top of the head. So far as the height of the vault is concerned, no race, type, sect, or intellect can lay claim to high, medium, or low vaults. They permeate through all classes of individuals.

NORMAL VAULT.

What constitutes a normal vault would be a difficult question to answer. I possess six skulls, obtained under difficulties from a medical college, and not selected for any particular purpose. The lateral measurement was made between the roots of the second bicuspids and the antero-posterior measurement from

between the central incisors to the posterior border of the palate bone at a point intersecting a vertical line dropped from the posterior nasal spine. The height of vault was measured along a horizontal line extending from the alveolar process on one side to the alveolar process on the opposite side just back of the second bicuspid teeth. The following are the figures:

	Lateral.	Antero-posterior.	Height of vault.
	In. mm.	*In. mm.*	*In. mm.*
No. 1	1.31 = 33.22	2 = 50.80	0.37 = 9.42
No. 2	1.25 = 31.75	2.12 = 53.84	.62 = 15.74
No. 3	1.37 = 34.79	2 = 50.80	.43 = 10.92
No. 4	1.56 = 39.51	2.37 = 60.17	.75 = 19.05
No. 5	1.62 = 41.12	2.25 = 57.15	.50 = 15.24
No. 6	1.25 = 31.75	2.12 = 53.84	.31 = 7.87

Nos. 1 and 5 possess very much the same contour of the dental arch, while Nos. 4 and 6 are very broad, with square dental arches. The heights of the vaults are all different, although two are flat, while the others are more or less rounding. If I were to hand you any one of these skulls and ask if it was a normal vault, you would most likely answer, yes. Yet all are normal as I view them, while no two are alike. I have examined hundreds of plaster casts where the teeth were all in a fairly normal position with similar results. Of 372 skulls of Peruvians, California Indians, Mound Builders, and American Indians, the lateral measurement varied from 1.12 to 1.75, and the antero-posterior from 1.75 to 2.75, while the height of the vault varied from 0.24 to 0.75. Oakley Cole made careful measurement of a number of skulls chiefly in the museum of the College of Surgeons, London, England. The skulls examined fall into two series, viz., those of European origin and those of mixed races, and the results were as follows:

	Number.	Average length.			Average width.			Height.		
		Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.
		mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm*	*mm.*
European skulls	34	58	40	49	42	31	*35	15	5.5	*9
Mixed skulls	32	65	43	54.9	40	29	*35	18	6	*12

* Taken at second bicuspid

In each of the cases that I have examined, the dental arch was in a normal condition. I have also examined the skulls mentioned by Oakley Coles, and I have been unable to find a contracted arch in any of them. If, therefore, in the examination of thousands of skulls having normal dental arches, no two vaults are found to correspond, we must conclude that a normal vault is one where the dental arch is regular and the different outlines possess graceful curves, regardless of height, width, and length.

BY WHAT STANDARD SHALL WE MEASURE THE VAULT?

The width of the vault depends upon two factors: first, upon the development of the jawbone proper; and second, upon the development of the alveolar process. Narrow jaws are rarely observed among the early races or modern pure races. In the examination of the thousands of skulls of early races in the museums of Europe and this country very few, if any, contracted vaults are found. This is also true of people who lead a quiet life, as illustrated in modern pure races. If the brain is in a healthy condition and the child properly nourished the jawbone will develop in size sufficient to accommodate all the teeth when they erupt.

The teeth will crowd against each other as they come into place, and a normal width of arch will be produced. If the brain is defective, as a result of some of the constitutional diseases and the jaw should become arrested in its development just before sufficient room had been secured for the teeth, they will crowd against each other, the arch will become broken, and the V or saddle arch, or some of their modifications, will be formed, hence a narrow, contracted vault. The amount of contraction depends upon the size of the jawbone proper; if the bone has become arrested early, the jaw being small, the contraction is usually very great. The alveolar process depends entirely upon the location of the teeth for its shape and size. Occasionally the teeth, which are small, are inherited from one parent, and the jawbone proper, which is large, from the other parent. In such cases the alveolar process will contract until all the teeth antagonize, when a small arch will be produced.

It has already been shown that the V and saddle shape arches and their modifications are observed as often among low vaults as among high ones, just as we have seen high and low vaults in normal jaws. The contraction is due to arrest of development of the jaw at the time of the eruption of the permanent teeth; the vault may be high or low. What appears to be a high vault is not in the height of the vault, but in the width. Having now explained the true cause of what appears to be a high vault, if we will refer to Clouston's classification we will find what he calls neurotic and deformed are both one and the same. Both are neurotic, but one is more contracted than the other. Both are due to arrest of development of the maxillary bones. In summing up our observation, we find that there are high and low vaults among the ignorant as well as the intellectual, among the colored as the white, among the brachycephalic and mesocephalic as the dolichocephalic, among the deformed or contracted as the normal. The width of vault depends upon the development of the maxillary bones; if they develop to a size sufficient to accommodate all the permanent teeth, there will be a normal vault regardless of height. On the other hand, if arrest of development of the jaw takes place these deformities result in a V or saddle arch or some of its modifications. How then shall we classify vaults? In the measurement of the height of vaults of 8,654 ancient and modern skulls in this country and Europe the highest was 0.88, the lowest 0.25, with an average 0.53. In the measurement of 6,387 mouths of living people over 20 years of age, the highest is 0.84, the lowest 0.21, with an average of 0.58. In the measurement of 616 insane people at the Eastern Illinois Insane Asylum, the highest is 1; lowest, 0.12, with an average of 0.54. Taking these figures into consideration, it is safe to average the height at 0.55. Allowing 0.15 an inch in each direction, we can call vaults which measure below 0.40 low vaults; those between 0.40 and 0.70, medium vaults; those above 0.70, high vaults. We could still classify those below 0.25 very low vaults, and those above 0.85 very high vaults.

The width of vault between second bicuspids in 8,654 ancient and modern skulls, maximum, 1.63; minimum, 1.13; average, 1.36. In 6,387 mouths of living people, over 20 years of age, maximum, 1.50; minimum, 0.93; average, 1.19. In 616 insane people, maximum, 1.87; minimum, 0.75; average, 1.16.

The vast difference between the ancient and modern skulls of this country and Europe and those of living individuals shows conclusively that the jaws are diminishing in size. We must therefore arrange a standard by which we are to compare the width of the vault as we find them to-day, excluding measurements of ancient and modern skulls. Taking the 1.19 as the average width of vault, we will say that any jaw below 1.10 is a narrow jaw; one between 1.10 and 1.40, medium width; and one which measures above 1.40, a wide jaw.

DISCUSSION.

Dr. M. H. Fletcher said that he considered the work that Dr. Talbot was engaged in as not second in importance to that of any scientific man in the United States, and that it was a real factor in the elevation of the profession.

Dr. J. L. Williams was glad to have heard Dr. Talbot's paper, and thoroughly approved the scientifically correct basis upon which he built up his conclusions.

Dr. Florentine Aguilar said there was great medico-legal importance in the studies prosecuted by Dr. Talbot, and it would be necessary to determine whether a high vault was or was not indicative of a disordered brain. He related a case which occurred some years since in Madrid. A priest who murdered the Bishop of Madrid was saved from death by his lawyer proving him insane, and it was brought out at the trial that a very high vault was a proof or an indication of insanity.

Dr. Daniel Guiterrez said that he had examined the mouths of many of the civilized Indians in South America. He found that they had unusually flat roofs to their mouths and good teeth, pyorrhœa alveolaris is unknown among them, and they are very rarely any of them insane.

THE RELATIONS OF SYPHILIS TO DENTISTRY.

By G. FRANK LYDSTON, M.D., of Chicago, Ill.,

Professor of the Surgical Diseases of the Genito-Urinary Organs and Syphilology in the Chicago College of Physicians and Surgeons; Attending Surgeon Cook County Hospital, etc.

It is not my intention to endeavor to present the comprehensive subject indicated by the title of my paper in all of its bearings upon the practice of dentistry. An entire book might be written upon this subject, and yet without doing it full justice. I will confine myself almost exclusively to generalities, but to such generalities as have a practical clinical bearing upon everyday dental practice. I will classify my subject as (I) the specific relation of syphilis to dentistry; (II) the nutritional relation of syphilis to dentistry. By the term specific I mean the relation of infectious secretion-bearing lesions about the mouth to dentistry. The second class embraces those disturbances of the teeth and jaws which are the result, not of the action of infectious syphilitic processes in loco, but of secondary nutritional aberrations incidental to the impression of syphilis directly upon the parts affected and indirectly upon these parts through the medium of the nerves and vascular supply.

I. It has appeared to me that the average dentist is inclined to overlook the possibilities of danger of transmitting syphilis to a healthy person through the medium of dental instruments and manipulations. A clean instrument from the standpoint of the dentist is not always a clean instrument from the standpoint of the surgeon. There are many men who consider that washing and wiping of instruments before and after manipulations about the mouth are all sufficient to prevent the possibility of the conveyance of infection.

I would at this juncture impress upon the dental profession the facts: (1) That an apparently healthy mouth may contain the poison-bearing secretion of syphilis. (2) That nothing short of the application of extreme heat, dry or moist, or the application of pure carbolic acid will make instruments surgically clean. It is by no means infrequent in my experience that syphilitic patients will submit themselves to dental manipulations without informing the dentist of their constitutional infection. In such patients an innocent so-called aphthous ulcer or "canker sore," as they are very frequently termed by the laity and by a certain class of

physicians, may be a poison-bearing syphilitic lesion. Operators who are brought in contact with the more aristocratic class of patients are rather loth to attribute lesions of the mucous membranes to syphilis, especially when such lesions resemble those innocent aphthous ulcers that frequently result from simple local irritation or from digestive disturbance. It is to be remembered also that a small mucous patch, syphilitic erosion or ulceration, or perhaps a small fissure, may exist at the bottom of some fold or reduplication of the mucous membrane and be overlooked, the mouth appearing on a superficial examination quite healthy. The poison-bearing lesion may appear and disappear very rapidly, yet the saliva and mucous secretion of the mouth may be none the less contaminated and remain so for some days after the complete disappearance of the lesion. It is by no means unusual for small syphilitic ulcerations to exist in the irregularities of the tonsils or folds of the fauces. A frequent location is between the pillars of the fauces, where only careful inspection can detect them. A superficial examination of the mouth and throat under such circumstances will disclose an apparently healthy oro-pharyngeal cavity. A small syphilitic ulcer or mucous patch may exist beneath the tongue or on the floor of the mouth, where it is concealed from ordinary inspection. Mucous patches far back upon the base of the tongue are frequently overlooked.

From what has been said, it is evident that from the standpoint of the possibility of infection, no mouth should be considered free from suspicion, and only by such suspicion can the dentist protect himself from the danger of infection of innocent patients. Several cases have come under my observation in which, while it would be difficult to positively prove that infection resulted from dental manipulations, my conscientious opinion is that infection resulted in this manner. I would warn the dentist particularly against the innocent-looking fissures and erosions of the lips and tongue which the patient usually fondly terms "cold sores." A benign-appearing fissure at the angle of the mouth may contain the contagium of syphilis. Oftentimes the patient himself is unconscious of the existence of syphilis in his or her system, but this innocence on the part of the patient is no safeguard against the infection of healthy persons. A very frequent lesion seen in the mouths of syphilitic patients is a superficial thickening of the mucous membrane, producing the so-called "milk spots." Here we have a pearly-gray infiltration of the mucous membrane with the syphilitic neoplasm, the secretion of which is highly infectious. I might remark that the secretions of the lesions of the mouth seen in secondary syphilis are the most infectious of all the manifold lesions of this disease, not even excepting a primary chancre. The frequency of the primary lesion of syphilis about the mouth is very much greater than is usually supposed. I have seen some thirty-odd cases of this kind. I have seen several cases in which patients presented themselves to me for diagnosis and treatment of primary syphilitic lesions of the tongue and lips, having been, at the time of my inspection, under the care of a dentist. The inference as to the danger of infection of healthy patients is at once obvious.

The safeguard of the dentist is: (1) To regard all lesions of the mucous membranes of the mouth, tongue, and throat as possible elements of danger of infection, no matter how innocent looking the lesions may be; (2) to remember that the healthiest appearing mouth may possibly contain in some obscure situation the poison-bearing syphilitic lesion; (3) that the secretions of lesions upon the mucous membrane in this location, certain tertiary lesions possibly excepted, invariably contain the contagium of syphilis in a highly active and virulent form; (4) nothing short of the application of prolonged dry or moist heat or immersion in pure carbolic acid can be depended upon to destroy this contagium.

II. Nutritional changes of the tissues which come within the immedate province of the dentist may be classified as (*a*) those due to hereditary non-contagious syphilis; (*b*) those due to congenital, active, and contagious syphilis; (*c*) those

due to the constitutional influence of acquired active syphilis; (*d*) those due to acquired syphilis that is no longer active, i. e., certain tertiary forms of the disease; (*e*) those due to nutritional disturbances produced by the remedies used for the cure of the disease. These varieties of nutritional disturbances require some special consideration. It is to be remembered that syphilis in the parents may manifest itself in the child in two ways: (1) As unequivocal syphilis; (2) in the form of what may be termed attenuated syphilis, which, properly speaking, is not syphilis at all, but comprises certain nutritive derangements incidental to a faulty constitution of the child due to the impression of constitutional syphilis upon one or the other or both parents. This has been generally overlooked, inasmuch as the physician is prone to classify such conditions under the more or less indefinite term of struma or rickets.

Parrot was not so far from the mark when he attributed rickets to hereditary syphilis. He, however, was inclined to term rickets "hereditary syphilis." As far as the relation of rickets to hereditary syphilis is concerned, I would say briefly that it consists merely of malnutrition incidental to a faulty constitution, which constitution is hereditary, and is due to malnutrition of the parents due to the syphilitic impression. It is not syphilis at all, and is not susceptible to the same treatment as true hereditary or congenital syphilis, but should be treated essentially upon the same therapeutical principles as rickets due to other causes of nutritional aberration. The same influence which syphilis is capable of imparting to the child through heredity may give rise to a faulty conformation of the jaws and a low grade of vitality of the structures of the teeth themselves, as a consequence of which irregularity of development, maxillary deformities, and premature decay may result. There is nothing specific about this relation of syphilis to dental pathology. On the contrary, this relation is a general and nutritional one.

The impression has been made upon me by the study of this subject that the *rationale* of the causation of these internal disturbances in the child is (1) a tropho-neurotic disturbance in the parents; (2) the transmission of this tropho-neurotic aberration to the child. The relation of tropho-neurotic disturbances to various manifestations of so-called "hereditary syphilis" is much more important than is generally believed. In fact, I have for some years held the opinion that many of the late lesions, and possibly some of the earlier ones, of acquired syphilis are due, not to the action of the specific virus *in loco*, but to nutritional perversions of a local character incidental to the impression of the syphilitic poison upon the sympathetic nervous system, the function of which is largely trophic.

(*b*) The lesions due to congenital and active contagious syphilis are in no wise different in their relations in dental practice from those of the acquired form of the disease. There is usually a clear history of the presence of the disease in the active form at an early period after birth, or perhaps at birth. Fortunately by far the majority of cases of congenital syphilis die during the first year, and those who eventually do come under the care of the dentist present lesions due to nutritional aberration rather than specific and active lesions. There are cases reported of hereditary syphilis in which the osseous lesions, particularly about the maxillæ and other bones of the face, have come at a very late period, but there is an element of doubt concerning a certain proportion of these, and in by far the majority of them previous lesions might have been detected had the cases been under careful and continuous observation.

(*c*) Active syphilis in the acquired form may produce a great variety of lesions of the mouth, jaws, and throat, mucous patches, ulcers, fissures, caries, and necrosis being the chief lesions. These are all contagium-bearing, and the dentist can not be too cautious in handling such patients.

(*d*) Under this head are certain carious and necrotic processes of the jaws and palate incidental to the tropho-neurotic influence of active syphilis. These lesions

are generally of a tertiary character, i. e., they belong, properly speaking, to the period of sequelæ. They are not supposed by many to be productive of contagion, although clinically they should always be regarded as possible contagium-bearing, inasmuch as it is impossible to tell positively at what time the active form merges into the period of sequelæ. They are always to be regarded, however, as septic. Necrosis of the palatal processes, nasal bones, and of greater or less areas of the superior and inferior maxillæ proper is frequent. It is generally supposed that these lesions are due to the pressure of the syphilitic deposit. By some they are attributed to the corrosive or local destructive action of the syphilitic poison. I regard these views as incorrect. The entire palate may be destroyed without any preëxisting pain, swelling, or any local disturbance which would be consistent with the view of pressure destruction of the bone. It will be found also that these lesions are limited by certain anatomical areas supplied by certain nerve filaments. The bone under these circumstances will be dissected out by the disease as cleanly as it could be done by the knife. A sufficient amount of cell deposit or local inflammatory action to produce complete destruction of one or both palatal processes of the superior maxilla could rationally be expected to be productive of great pain, local swelling, and other manifestations of the local destructive process. *Per contra*, very often the patient will present himself to us with a history of a small ulceration in the hard palate. The introduction of the probe will disclose, much to the patient's surprise, the presence of a sequestrum, involving, perhaps, the entire osseous tissues of the palate on one or both sides. I can not explain this peculiar condition upon any other theory than the existence of a tropho-neurotic disturbance which has so cut off the nutritional activity of the bone that death has resulted.

(*e*) It must be remembered that mercury used in excess or in special cases of idiosyncrasy is liable to produce inflammation or ulcerations of the mucous membranes, or carious and necrotic osseous processes that are in no wise different clinically from those produced by the disease *per se*. A fallacious notion exists in the minds of the laity, and I was about to say of the medical profession as well, that syphilis is a specific poison for which the natural antidote is mercury. As a corollary of this fallacious notion it is supposed that the larger the amount of the antidote short of killing the patient the sooner and more effectively the syphilis may be stamped out. As a result of this fallacious notion much damage has been done. If the nutrition of the patient be seriously impaired by mercury and iodide of potassium during the active stage of syphilis, it is a noticeable fact that as soon as the immediate effect of the remedies has passed away the syphilitic processes, favored by the constitutional debility induced by the remedies, not only break out afresh, but with renewed vigor.

I am aware that there are many deficiencies in the foregoing paper, but I trust that I have given this section food for reflection, and I rely upon the discussion to bring up many points which I could not well present in a paper of so general a scope.

DENTAL MEDICATION AND EXPERIMENTS WITH CASES.

By V. A. LATHAM, F. S. S., F. R. M. S., D. D. S.,

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To-day we stand on the threshold of scientific investigation, more particularly, perhaps, in dental surgery and pathology than in any of the medical sciences, for so far this department has had to stand behind its fellows, shall we say by reason of its low position in the minds of both the public and the medical profession? Happily is it that Profs. Mills and Underwood came forward and gave their ele-

mentary work in the Transactions of the International Medical Congress in 1881, and Black in this country, and since then Prof. W. B. Miller, to whom the entire dental profession owe many obligations for his increasing and beneficial results in the field of bacteriology as allied to the dental profession. As yet few of our dental schools teach the sciences of histology, pathology and bacteriology as they should be taught, or even require their students to learn these subjects in the medical department. Is it not true that the dental surgeon has to deal with the body in almost the same character as the general surgeon? Can general and dental surgery be separated from one another at all when we consider the meaning of anatomy, sepsis, pathology, etc.? I think not, for who knows what disease has in store for him who decides to treat an abscessed tooth? Does he not have to consider histology, anatomy, and the relation of the tooth, the cause and condition of the tissues, the changes going on at the time, and the effects likely to be produced on them? Must he not also consider the dangers of sepsis, all its resultants, leading to perhaps deformity, loss of structure, and possibly of life? Under these conditions can we not urge that the students of to-day be more thoroughly taught if they intend to save and repair diseased organs? Does not the public understand the vast strides lately made in all scientific investigation and demand such training? How many of the students of this period realize the fact that scientific medication is needed, and not the empiric use of one remedy in every case simply because his training has been derived from some respected and eminent teacher who prefers creosote to cloves for all conditions, and who to save himself the expense and trouble is content with it. We see how difficult it is to know what remedy to use when we are not thoroughly acquainted with the physiology and histology, to say nothing of the pathology, of an organ. In dental science the question comes, how can we obtain the necessary amount of dryness without coagulation first being produced? The common agents all more or less belong to this group of coagulating substances, as, for example, alcohol, ether, air-heated chloroform, and many of the essential oils. This is a difficult subject to answer, the best and only true way being constant drying with absorbent paper, wool, and spunk; a thorough washing of the tooth in sterilized cold or warm water; then choosing an agent suited for the case, either deodorant, disinfectant, antiseptic, or germicide, provided it does not coagulate and so place a most formidable barrier to its own penetration by coagulating the albumin, as do carbolic acid, bichloride of mercury, etc. These agents must not be used, but one that has such a mixing and diffusing power that it is able to penetrate to a considerable distance and so permeate through all the substance likely to be dangerous and at the same time not disturb or irritate the surrounding tissues in any degree sufficient to cause any molecular change, so producing a pathological condition. Therefore, to be thorough we must learn what drug is capable of miscibility in water, saliva, or mucus; in fact, what agent is readily diffusible through water, for in this locality we can hardly make an aqueous emulsion as we understand the term in pharmacy, agitation being impossible, the nearest approach being to saturate the cavity of the tooth with some essential oil not much, if any, heavier or lighter than water, which by application in such a degree will soon become almost, if not quite, a mixed solution on account of concentration, and so become a graded-strength solution exactly on the principle used in hardening material in graded strengths of alcohol. When we have done this it is clear we are approaching our object of having an antiseptic action which can be followed by a germicidal agent. When we have succeeded in destroying the microbes in the tissues, then, and not till then, is the time to use agents which have stronger actions and coagulating properties. Because at this point we can use coagulants most readily and these substances act as embalmers and protect the tissues from contact with the air and fluids of the mouth. They thus act as a safeguard against further inoculation of ærobic

germs and at the same time prevent the origin and growth of anærobic germs. From this, then, we gather that the most critical time in treating is during the withdrawal of water and the saturation by an antiseptic and germicidal non-coagulating agent. To find those remedies which are satisfactory is the present duty of experimenters in this line. Mechanical means, as capillary attraction, will do much to aid in the removal of water. No substance is of any value as an absorbent unless it can take up at least 5 centimeters in height of liquid, and so wood-wool, wood-cotton, and cellulose-cotton offer the greatest promise. Then thorough washing with listerine and peroxide of hydrogen, when the softened dentine can be cut away. Eucalyptus (Sanders's) will mix with listerine and gradually permeate the teeth. If we use some remedy which liberates oxygen we find it penetrates the tubuli and acts as an antiseptic, as a deodorizer, and as a bleaching agent. Then the tooth should be soaked thoroughly by a dressing of eucalyptus or some other non-coagulant and non-irritating oil, and the final cutting away of the dentine. I find the best plan is to permeate the tooth substance with some antiseptic oil for a few days, then to change the dressing and place a paste of aristol or iodol in eucalyptus or other oil over the dentine, then a plug of cotton, followed by a sandrach plug, and lastly a temporary stopping of gutta-percha or oxyphosphate. When this is removed the tooth can be dried by using warm, not hot, air, then chloroform or ether, followed by eucalyptus, and then if a stronger agent is desired carbolic acid will answer nicely, provided it is used strong, if the cavity extends to any depth and the pulp in danger of being reached. In superficial cavities a 1 to 40 solution can be used, but it must always be borne in mind that the weaker the acid the more it will penetrate, and judgment must be used in all the cases. Bichloride of mercury, if preferred, can be used in place of the carbolic acid, for they are both germicides and coagulants.

Another question of great importance is the testing of our coagulating albumin agents, by using antiseptics and germicides to see if they are able to penetrate this coagulum, for if this is possible we need not fear that we shall not be able to kill the majority of microörganisms present in any cavity. We can permeate the tubuli everywhere; yes, and even the pulp, and so produce a thoroughly aseptic tooth. In cases where we have large cavities, for example, in molars, where we wish to leave some softened dentine over the pulp in preference to exposing it, this will be one of the greatest gains in dental pathology, for sterilized dentine is unquestionably the best capping we can find; and if the agents used do not prove irritants to the delicate pulp the danger may be considered as past. In such cases as the above I have had great encouragement by the leaving of a paste of aristol and eucalyptus over the softened dentine, and capping over it, and temporary filling on that. Aristol combined with stearate of zinc, iodol, and iodoform can be used in the same manner by those who prefer them, using as an adjunct any of the volatile or essential oils which may be suited to the case. It must be remembered that the oils vary considerably in their chemical action, some being more diffusible, others said to be more powerful germicides, though this property is doubtful among them in the true sense of the word. Others, on account of the tannin they possess, coagulate quickly; others are stimulants to a great degree and even become irritants and vesicants. Oil of turpentine and terpinol, of Merck, are hydrocarbons, but myrtol and cassia are more potent as antiseptics than the other oils, but they are more stimulating and so irritating and must be used with caution near the pulp, or irritation or inflammation is liable to be produced. The oils are useful to mix with carbolic acid to diminish its escharotic power; they will also dissolve iodine compounds, hence their value in mixing with aristol, iodol, etc. They combine nicely with glycerin and some can be formed into emulsions, as they have a very slight solubility in water. There is no danger of discoloration of a tooth when a volatile oil is sealed in a cavity, for they all absorb

oxygen, and its power of bleaching is so well known as to need no comment; but the cavity must be thoroughly dried before introducing the oil. If we can dilute the fluids of the tooth, as the quantity is small, we can then use our coagulants with some degree of safety, for we can combine agents with diluted blood, albumin, etc., which will not produce quite such a heavy and impenetrable coagulum. In teeth where the pulp has been freshly removed immediate root filling is not safe as a general rule. In almost every case where surgical treatment has been required we have a wound, from which we have exudate, and this is almost always inflammatory. This secretion is liable to form a coagulum, and as blood serum is an excellent medium for bacterial growth we must watch and treat it most carefully. If the pulp has just been removed it is well to use some normal fluid, as salt solution, to wash out the root, in preference to water, as the exudate will be kept in a fresh state and not coagulated, and it can be more readily washed away and leave no deposit at the apex. When this is got rid of, soak with eucalyptus for a day, then treat with a mixture (E. E. C.) ℞. eucalyptus (Sander's), 3 parts; Ol. cassia, 2 parts; eugenol, 1 part; mix. Carbolic acid, cloves, or any other agent can be used in place of the cassia if desired, and it forms a safe and pleasant antiseptic. Then after a day or two or a week the root can be dried thoroughly with chloroform, ether, or warm air, then bichloride of mercury, provided it contains tartaric or citric acid, which not only keeps the solution but aids somewhat against coagulation or, if preferred, crystals of carbolic acid may be placed in the root and a hot probe passed down. The heat melts the acid and cauterizes at the same time. Then fill the root with gutta-percha, dissolved in equal parts of eucalyptus and chloroform, the pulp chamber with cement, and then finish with gold. Naphthol and napthaline are excellent antiseptics and are useful for pulpless teeth, as they do not become stained. As antiseptics they are very valuable where a dressing is required for exposed pulps, as is also the mixture given above. It is cheap, simple to use, deodorant, and induces a rapid growth of healthy granulations.

In microcidine, a compound of naphthol and sodium hydrate, we have a germicide and inhibitor of germ growth. It is ten times as powerful as boric acid. In a solution of $\frac{3}{1000}$, which is the strength for general use, it is a most excellent wash where there is a free discharge of pus and produces no irritation of the mucous membrane. It also prevents fluids from becoming putrescent, especially urine, for thirty-six hours. It has a great advantage by being very soluble in water; neither does it corrode instruments, nor stain clothing or tissue. Iodine water is a most excellent antiseptic fluid for irrigation of suppurating wounds, as it is for fresh wounds, and as it is a normal fluid its effect on the blood and pus is simply to keep them liquid. It is of especial value in dying or suppurating teeth.

What do we mean by permanent antiseptic dressings of wounds, and what are their desired qualities? We mean a dressing applied immediately after an operation and left till the wound is healed. The qualities we should try to obtain are: (1) As perfect hæmostasis as possible. (2) Absolute asepsis of the wound or part. (3) Perfect drainage. (4) Sanguineous oözing reduced to a minimum, rapid absorption of any liquid by the dressing, and especially if in deep cavities. (5) Antiseptic action to be exercised by the latter upon the liquids which impregnate them, and so preventing decomposition, fermentation, and putrefaction. (6) Coagulating agents must be avoided until the tissues are antiseptic, and then and not till then can such germicidal agents as carbolic acid or bichloride of mercury be used. (7) The absorption even in small quantities must be watched, and especially in iodoform and mercury, from both of which poisoning and irritation are liable to result. (8) Mechanical and chemical indifference (irritability) to the edges of the wound.

Aseptol (sulpho-carbo-ortho-oxyphenyl-sulphurous acid) is a syrupy, rose-colored, volatile liquid, with a strong odor, and is non-irritant. It has the following good qualities as proven by numerous experiments. (1) Aseptol readily dissolves in every proportion of water, alcohol, and glycerin. (2) It is more acid, but at the same time less caustic than carbolic acid, and it directly combines with bases. (3) It is perfectly harmless. (4) Its anti-fermenting, anti-putrid, and disinfectant properties are more energetic than those of carbolic and salicylic acids, and so it recommends itself as a substitute for carbolic acid, and is a valuable hygienic agent. (5) It can be combined readily with essential oils. A mixture of carbolic acid 67 parts with resorcin 33 parts, to which 10 parts of water have been added gives a liquid mixture which will remain so, and is soluble in all proportions with water, and its use as an efficient and convenient antiseptic preparation is readily seen. Sulpho-carbolate is a useful agent for dental work, as it is readily soluble in distilled water or alcohol. A solution of 10 to 15 per cent destroys microörganisms entirely, while a 5 per cent solution only arrests their movements. Wool and dressings are readily impregnated with the salt, and in consequence of its trifling volatility the antiseptic power is retained for a long time. It is non-poisonous, non-irritant, does not produce local anæsthesia or eruptions even if applied to the mucous membrane. It is useful as a powder and can be combined with other agents. Some consternation was caused to members of the profession when Dr. R. B. Miller's paper on Iodoform appeared in the Dental Cosmos. If these experiments are true, why is the drug so much used in hospital and medical practice in spite of its disagreeable and dangerous qualities? Has not the preparation of the drug, its solutions, and methods of application a great deal to do with these bad results? I think if the drugs can be prepared in a sterile way such trouble and misunderstandings could be obviated to a large extent. Iodoform may be used in several ways: (1) In very fine powder; (2) pencils either made with gelatin which is elastic; cocoa butter, wax, etc., which are rigid; or pencils of 5 to 10 grains of the drug are excellent, and can be made like the nerve-filling points; (3) iodoform gauze (10 to 50 per cent solution in either) for wounds, drainage, etc.; (4) as emulsions, iodoform 10 to 50 per cent, glycerin and water equal parts, and tragacanth O. 25 per cent or with oil, for wounds of joints, abscesses, etc.; (5) iodoform 1, benzole 9, zanolin or vaseline 11, and oil eucalyptus 2 minims, injected in lymphadenitis. So far no trouble has occurred in the use of iodoform when sterilized. I use olive oil sterilized by boiling, or some of the essential oils. The iodoform is added after cooling the oil, 10 per cent by weight. The vessel in which the oil is received is previously sterilized by washing and followed by sublimate solution, the bichloride being washed out by ether or alcohol, the former being preferable. The best preparation of iodoform is that prepared by means of electrolytic action according to the method of Schering. The inflammatory reaction so often noticed is not seen after thorough sterilization. Even when used as an emulsion in tuberculosis, etc., the results are excellent. A useful antiseptic mixture is that recommended by C. Cavazzini, composed of iodoform 55 parts, salicylic acid 20 parts, submitrate of bismuth 20 parts, camphor 5 parts, or I prefer to add an essential oil in place of the camphor, for then we get both the oil and camphor effect. For indolent granulations in sinuses it quickly stimulates them, and suppuration rapidly disappears. Iodoform, either pure or in strong solution, has a very striking effect upon the nerve endings. It is more powerful in this respect than carbolic acid, its effects are more lasting, and it is of great value in suppurating pulps and where sensitiveness still exists through the odontoblast cells being irritated or dying after removal of pulps by arsenic or by nerve extractors. A drug which so far is fighting for its existence in the vast field of materia medica, and which is so closely allied to iodoform, is dermatol. As yet it is upheld and condemned by many in the profession, but in my hands it has shown itself worthy of considerable further trial. It was first discovered by Heintz

and Liebrecht, who convinced themselves of its freedom from poisonous properties by experiments on animals. Doses up to 45 grams, repeated for several days, proved entirely harmless to rabbits, while 1½ drams *pro dosi* was given by stomach tube to dogs and rabbits and no toxic effects seen. As an antiseptic agent it prevents putrefaction, and also the development of bacteria when used as a 1.10 per cent solution. Poisoning by internal administration of bismuth salts has been very rarely seen, as they are not readily absorbed from the alimentary canal; yet they can be absorbed from the surfaces of wounds, ulcers, and lead to severe poisoning with symptoms similar to those of mercury. (Dermatol introduced in amounts of 30 to 45 grains into subcutaneous tissue pockets in animals, and also when placed in contact with the peritoneum, produced no symptoms of illness nor were any pathological phenomena found after killing the animals.) Experiments on human beings in surgical, medical, obstetrical, and gynecological cases showed it also to be harmless.

The harmlessness of dermatol in contrast to such bismuth salts as the subnitrate of salicylate seems to be due to its insolubility and constancy. Bacteriological experiments made under conditions as closely as possible similar to that which obtains in the living body, at a temperature of 37° C. under exclusion of light and in the presence of moisture, after first sterilizing the dermatol by steam and control experiments made, the results were negative, except where the drug was scattered in very thick layers over the inoculated areas. This effect is also seen when iodoform, iodol, or aristol are used in the same way. Dermatol is chemically a basic gallate of bismuth, is an exceedingly fine saffron yellow powder, closely resembling iodoform, which is not hygroscopic nor shows any effect by the action of air, light, or heat, and in this manner is superior to all the above-named agents. It is tasteless and odorless, innocuous, in a high degree exsiccant, and promotive of granulation. The subgallate of bismuth will stand a temperature of 212° F. It is relatively insoluble and has a fatal action upon bacteria when in immediate contact with the substance to be acted upon. Dermatol is rapidly absorbed, and aids healing by its drying influence on a wound, since by withholding from the bacteria the fluid which is essential to their growth, it brings about their destruction, and also, by virtue of its kolyseptic action, viz. its restraining influence upon the development of bacteria, it is destined to take a permanent position among the drying antiseptics. What are the advantages? (1) It can be rubbed into gauze, then sterilized by heat or steam without altering the chemical nature of the drug or destroying its properties. (2) It saves the unpleasant necessity of changing dressings so often and is of especial value in freshly sewed bowel wounds and in permeoplasty. (3) It protects the wound as no other remedy can, and enables the surgeon to remove sutures much earlier than where other applications are used. (4) Gauze impregnated with dermatol and used as tampons is of great value in the treatment of vaginal catarrh. (5) Dermatol suppresses secretions, whilst iodoform increases them. Glaesar thinks iodoform is better applied to putrid wounds and suppurating tracts than dermatol, the last being used only when the wound is already antiseptic. (6) For diarrhœal affections, in typhoid fever, dysentery, phthisis, etc., it has no equal. Dose, ss., in 4 doses. (7) For burns from either fuming nitric acid, hot water, or hot fat it is excellent when applied as a salve. (8) In diseases of children, as 10 per cent with vaseline or lanolin on lint, gauze, etc. In otitis media, as a powder blown in. In skin diseases the drying properties are especially useful. (9) In surgery, strongly secreting wounds, ulcers, abscesses, etc. Methods of use: As powder, through insufflator, on gauze, dusting; as liquids and pastes, in emulsion of collodion, glycerin, essential oils; as ointment, with lanolin, wax, zinc oxide, or paraffin. (10) Wounds always heal without local reaction, febrile symptoms, or suppuration, and by the absorbing power it abstracts the moisture and so deteriorates

the nutritive value of the tissues. In dental surgery dermatol gave excellent results in chronic alveolar abscesses, both with and without fistulous openings, suppurating pulps, inflammation of the gums, and pyorrhœa alveolaris.

Case 1.—In one case, which will do for a type of all, I found the patient, a lady, age 18, had a large abscess on the buccal surface, extending over the second superior bicuspid and first superior molar of the left side. A large cavity in the coronal, proximal, distal side, which, after applying the rubber, I washed out with warm sterilized water and cut down and beveled the enamel walls. Then drying the tooth as well as I could with bibulous paper, spunk, etc., I applied a pledget of wool with pure listerine (Lambettes), soaked the cavity, then cutting the débris and softened dentine I soon opened up the pulp chamber and root, and then reached a quantity of greenish-yellow pus. This I washed out with listerine and then cleansed with a rough probe and a smooth one with bibulous paper on it in preference to wool. I then washed out with listerine in preference to peroxide of hydrogen, as an accumulation of free oxygen is not good unless a direct outlet is present. I then introduced eucalyptus and left it in contact, but loose, followed by a dry plug of wool and then another dipped in sandrach varnish. After removing the rubber I opened the pus sac freely, after first touching it with carbolic acid to render it painless and antiseptic, well washing out the sac with sterilized warm water, peroxide of hydrogen, and finally packing with gauze dipped in the mixture E. E. C., above given. The patient had allowed this condition to become chronic, and a good deal of chronic inflammatory tissue was present through the occurrence of continual cicatricial openings. In the R. S. first molar was a large cavity and three small abscess sacs over the buccal surface, and a fistulous opening from the palatine root; also a long-standing case. This was treated in a similar manner, and the patient told to come the next day, when the canals were well cleansed, oil of cassia in the left bicuspid and eucalyptus in the right molar, the wound cleansed, and fresh gauze inserted. Good results followed until about two weeks after, when an increased discharge showed in the left bicuspid, which seemed difficult to get rid of, as it was apical and the abscess was still well open. I then washed it thoroughly and made a paste of eucalyptus with dermatol, and with fine nerve probes, etc., forced up all I could, and even through the apex, covered the paste, and put in a temporary gutta-percha filling, as the patient wished to go away for a while. After two weeks, on removing the stopping, I found considerable of the drug absorbed, what was left being a fine dry powder. This I wiped out thoroughly with eucalyptus on bibulous paper, and then dried with chloroform and finally ether; inserted dry cotton, plugged temporarily, and after a week, as no bad results showed, I filled the roots and crowned, and so far have had no further trouble. The right side gave much trouble, and as a final resort I used dermatol in it with excellent results.

Case 2.—A young boy with a cut in the sole of the foot, which had been very badly neglected for two weeks; pus present in great quantity; much odor and pain. The foot was carefully washed in sterilized water, the necrotic epidermis, etc., cut away, and the wound covered with dermatol in a thin layer. This improved the condition. At the next dressing the drug was dusted over in a large quantity, covered with oil silk to prevent adherence of the dressing to the wounded surface, the whole bandaged, and as the boy would not keep quiet the case seemed likely to require some time to heal. But after a few days, the dressing being left undisturbed, the result was most gratifying; suppuration ceased, the remaining necrotic tissue was thrown off, under which the granulating surface was rapidly formed, and without irritation covered with epithelium.

In experiments with cultures of staphylococcus the growth stopped on applying dermatol. Bacteria (12 different varieties) were cultivated on agar jelly. Three tubes were in each case inoculated, one of which for control purposes was left free from the agent. Over the surface of the second, dermatol was very lightly scattered by a spray apparatus, while the third was thickly covered with dermatol. One species of staphylococcus showed the most flourishing growth after three days in the control tube, while in both the others, where dermatol was scattered, not a trace of the development could be discovered. On the fifth day the surface of the two latter was scattered with a needle and fresh inoculations were made; neither here did any growth occur. Agar, colored with indigo-carmine, 1 per cent, and 2 per cent of dermatol, added in each of two tubes, A and B, well mixing the liquid and pouring out in cold Petri dishes. In a third tube, C,

no dermatol, staphylococci introduced, and the whole placed in the incubator. In C decoloration after three days, while in A the same stage was not reached in the dish till the tenth day; in B not till the fifteenth day. Vibrio Finkleri, Vibrio choleræ Asiatica, Bac. Syphi. Abdom. showed difficult and limited growth under the influence of dermatol; while with M. Tetragenus and Bac. subtilis anthracis the cultures remained quite sterile.

These few points show that dermatol is likely to prove very advantageous in dentistry and in medical work, but it requires a good deal more careful examination to prove its exact position. A fact to be remembered is that for the dose of a drug to act antiseptically it is not necessary that the dose of the drug employed be able to kill the microbe; it is sufficient that such a dose enables the leucocytes to triumph over the germs in question. Often the same amount of, say, the mercuric salt diminishes the power of both kinds of bodies, but it is important that the action exercised be such as to enable the leucocytes to conquer, as it were, the microörganisms. The aim, as we all know, is rather asepsis than antisepsis, the prevention of germs from gaining access to wounds instead of attacking them only after they had got there. The more rapidly wounds and other lesions can be closed up and repaired, by so much is the risk of bacterial infection reduced. Hence the demand for wound-healing agents in practical surgery and dentistry; and so long as we must use them, it behooves all who have these agents in active work to contribute their results from time to time with carefully recorded cases for or against these agents, so that after a time many unreliable and needless drugs could be set aside.

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BREVE NOTICIA SOBRE A ARTE DO DENTISTA NO BRAZIL.

POR ARISTIDES BENICIO.

Até o anno de 1881 não havia nas faculdades de medicina do Brazil curso de cirurgia dentaria nem tão pouco instituto particular onde se podesse preparar o aspirante á profissão do cirurgião dentista. A aprendisagem era feita extra-officialmente.

O individuo que pretendia exercer essa profissão requeria á faculdade de medicina exame de habilitação para o referido exercicio. Esse exame constava da descripção anatomica de um dos maxilares, do modo porque se obturava um dente e como se fasia uma dentadura; d'isto constava a prova oral. A prova pratica era... a extracção do dente no cadaver! Erão examinadores os lentes da faculdade em numero de tres.

Não era exigido nem um só preparatorio, razão porque encontra-se no Brazil dentistas quasi analphabetos, alguns oliór bons praticos.

Em 1882, reformando-se o regulamento das referidas faculdades, creou-se um logar de preparador de cirurgia dentaria, logar que só pode ser exercido por um cirurgião dentista. Creou-se mais nessa mesma epocha os cadeiros de anatomia, phisiologia, pathologia e therapeutica dentarias, professados, porém, pelos lentes

substitutos dos respectivos cadeiros (doctores em medicina). Ao preparador competia explicar prothese e trabalhos de gabinete. Exigio-se de então para cá as tres provas—escripta, pratica e oral. Começou d'ahi a cirurgia dentaria a progredir entre nós.

Hoje, depois de subsequentes reformas, já temos um instituto odontologico annexo ás faculdades de medicina com um curso senão completo, pelo menos regular, pois alem dos cadeiros acima temos mais a de clinica odontologica e a de prothese dentaria, que têm por professores cirurgiões dentistas.

Já se vê que pelo andamento que tem tomado nestes dez ultimos annos a cirurgia dentaria no Brazil, será de progressiva senda e brilhante futuro neste paiz a profissão do dentista.

Ha dez annos não se cogitava do exercicio do dentista nos estabelecimentos publicos, nem nos hospitaes; hoje contamos no primeiro estabelecimento de caridade brazileiro—o Hospital da Santa Casa da Misericordia—(um dos primeiros do mundo) um excellente gabinete de cirurgia dentaria, onde funccionão effectiva e diariamente dous dentistas, o director do consultorio e o seu adjuncto. O Recolhimento dos Orphões, a Casa dos Expostos, o Hospicio de Alienados têm bem montados serviços de cirurgia dentaria dirigidos pelo mesmo profissional que se acha á testa do referido serviço no Hospital da Santa Casa. A Beneficencia Portugueza tem tambem, no seu hospital montado, o serviço dentario. A Brigada Policial conta no seu corpo sanitario um cirurgião dentista, bem como o Collegio Militar, alem de outros estabelecimentos e corporações publicos e particulares que sustentão serviço identico.

Referindo-me ao instituto odontologico esquicia-me mencionar os cadeiros da hygiene e hystologia, e declarar que para a matricula no instituto o candidato tem apresentar certidão de exame das materias preparatorias: portuguez, inglez ou francez, arithmetica, geometria, phisica e chimica.

Tudo isto prova que a arte do dentista progride a passos largos nos Estados Unidos do Brasil.

Junto remetto algumas estatisticas do serviço a meu cargo no Hospital da Casa Santa. Não é um trabalho completo, ao contrario está longe d'isso, é, porem, o inicio de futuros estudos e observações, quiçá, proveitosos.

Mappa estatistico do Gabinete Dentario do Hospital geral da Santa Casa da Misericordia.

ANNO COMPROMISSAL DE 1886 A 1887.

Mezes.	Consultas a.			Operações.				Receitas.
	Homens.	Mulheres.	Creanças.	Extracções.	Obturações.	Cauterisações.	Resecções.	
Julho	105	198	67	461	109	255	.....	53
Agosto	107	205	79	508	87	282	1	94
Setembro	103	225	79	496	132	361	.....	85
Outubro	137	202	93	590	147	289	1	70
Novembro	148	239	168	742	137	213	..	72
Dezembro	143	219	123	536	95	213	1	68
Janeiro	160	180	130	565	104	127	1	52
Fevereiro	146	175	112	555	76	107	.....	44
Março	150	216	115	547	80	148	.	75
Abril	144	228	124	543	107	187	1	71
Maio	125	218	141	621	90	141	1	53
Junho	138	223	125	455	113	193	1	57
Total	1.607	2.528	1.356	6.619	1.286	2.516	7	791

Mezes.	Diagnosticos.							
	Carie dentaria.	Nevralgia.	Periodontite.	Epulide.	Stomatite.	Gengivite.	Necrose.	Fistulas.
Julho	145	11	8	.....	.....	6	.....	4
Agosto	166	9	6	.....	2	8	1	1
Setembro	192	6	4	.....	.....	6	.....	.....
Outubro	280	4	10	1	4	5	2	2
Novembro	265	1	7	.....	.....	1	.....	.....
Dezembro	224	9	10	.. ....	1	....	.....	.....
Janeiro	319	8	8	1	3	... .	1	.....
Fevereiro	314	.....	6	.....	.....	. . .	1	... ..
Março	362	3	3	.....	1	... .	..	.....
Abril	344	6	7	1	.....	4	2	1
Maio	319	10	8	.....	.....	.....	1	.....
Junho	345	5	11	.....	2	5	. .	.....
Total	3,275	72	88	3	13	35	8	8

Observações.—Além das operações mencionadas foram praticadas mais duas reimplantações com o mais feliz resultado; sendo uma a de um incisivo central affectado de periodontite chronica e duplamente fistuloso, em uma senhora de 30 annos mais ou menos; e outra a de um premolar tambem fistuloso, em um menor de 16 annos. Segundo as observações feitas durante o anno neste Gabinete pôde-se estabelecer approximadamente nos dentes attingidos pela carie a seguinte media: Incisivos superiores, 6 per cent; incisivos inferiores, 1 per cent; caninos superiores, 2 per cent; caninos inferiores, 1 per cent; premolares superiores, 12 per cent; premolares inferiores, 7 per cent; grandes mol. superiores, 22 per cent; grandes mol. inferiores, 49 per cent. Notando se ainda serem os dentes do lado direito mais perseguidos pela carie, exceptuando-se os incisivos inferiores que são atacados igualmente de ambos os lados, e os premolares e grandes molares superiores que apresentam um pequeno accrescimo na média para o lado esquerdo.

ANNO COMPROMISSAL DE 1887 A 1888.

Mezes.	Consultas a				Operações.					Receitas.
	Homens.	Mulheres.	Creanças.	Total.	Extracções.	Obturações.	Cauterisações.	Resecções.	Total.	
Julho	176	214	127	517	553	104	175	1	833	58
Agosto	182	251	141	574	728	84	111	1	924	55
Setembro	121	239	130	490	640	52	109	0	801	33
Outubro	153	229	147	529	710	66	118	0	894	49
Novembro	139	230	136	505	632	76	120	0	830	49
Dezembro	136	185	140	461	593	41	80	0	714	46
Janeiro	191	286	159	636	732	71	123	0	926	74
Fevereiro	184	207	121	512	548	93	134	0	775	41
Março	137	182	124	443	554	81	102	1	737	26
Abril	153	183	143	479	573	54	75	1	703	65
Maio	134	208	150	492	577	60	134	1	712	67
Junho	126	192	118	436	442	52	135	0	629	65
Total	1,832	2,606	1,636	6,074	7,282	834	1,386	5	9,478	628

Mezes.	Diagnosticos.									
	Carie dentaria.	Nevralgia.	Peri-odontite.	Osteo-periostite.	Stomatite.	Gengivite.	Necrose.	Fistulas.	Epulide.	Fractura.
Julho	412	10	7	0	2	8	2	3	0	0
Agosto	470	8	7	1	4	7	0	0	0	1
Setembro	393	7	6	0	4	4	0	0	1	0
Outubro	430	2	6	1	2	1	1	0	0	0
Novembro	417	4	1	0	1	0	1	1	0	0
Dezembro	370	5	6	0	2	1	1	0	0	0
Janeiro	529	5	5	0	1	1	0	1	0	0
Fevereiro	439	0	1	0	0	0	1	1	0	0
Março	369	1	0	0	0	0	1	0	0	0
Abril	378	6	4	0	1	4	1	0	0	0
Maio	389	8	7	0	3	6	1	3	0	0
Junho	285	8	9	1	1	3	0	2	0	0
Total	4,881	64	59	3	21	35	9	11	1	1

Observações.—As consultas em numero de 6.074 com o consta do presente Mappa foram dadas a 4.242 pessôas matriculadas durante o anno no respectivo livro, sendo 1.424 homens, 1.625 mulheres e 1.193 creanças. Continuando as observações relativas aos dentes attingidos pela carie foi obtido o mesmo resultado do anno passado, com pequenas differenças, podendo ainda estabelecer-se a seguinte média: Incisivos superiores, 6 per cent; incisivos inferiores, 1 per cent; caninos superiores, 2 per cent; caninos inferiores, 1 per cent; premolares superiores, 12 per cent; premolares inferiores, 7 per cent; grandes molares superiores, 22 per cent; grandes molares inferiores, 49 per cent. Nos incisivos superiores e nos grandes molares superiores e inferiores nota-se que são attingidos pela carie mais os do lado esquerdo do que os do lado direito dandose justamente o contrario com os premolares superiores e inferiores, sendo entretanto os incisivos inferiores e os caninos superiores e inferiores atacados igualmente de ambos os lados. E' nesta ultima parte que existe a differença entre as observações deste anno e as do anno passado, pois somente quanto aos incisivos inferiores e grandes molares superiores ellas combinam, divergindo quanto aos outros. Em subsequentes observações chegar-se-á a um resultado definitivo.

ANNO COMPROMISSAL DE 1888 A 1889.

Mezes.	Consultas a.				Operações.				Receitas.
	Homens.	Mulheres.	Creanças.	Total.	Extracções.	Obturações.	Cauterisações.	Resecções.	
Julho	144	218	153	515	633	71	141	0	46
Agosto	132	240	174	546	576	92	117	0	57
Setembro	183	236	171	590	698	97	139	1	63
Outubro	196	263	189	648	748	88	170	0	71
Novembro	166	209	160	535	624	69	106	0	71
Dezembro	166	178	138	482	638	34	54	1	49
Janeiro	153	241	134	528	632	79	144	0	63
Fevereiro	138	165	123	426	499	40	81	0	89
Março	129	148	88	365	407	23	76	1	79
Abril	170	221	154	545	617	57	130	0	79
Maio	147	231	157	535	593	65	131	1	89
Junho	115	184	134	433	505	46	87	1	79
Total	1,839	2,534	1,775	6,148	7,170	761	1,376	5	736

Mezes.	Diagnosticos.								
	Carie dentaria.	Nevralgia.	Periodontite.	Stomatite.	Gengivite.	Necrose.	Fistula.	Epulide.	[illegible]
Julho	378	7	5	4	3	3	2	0	0
Agosto	382	5	4	2	2	0	4	0	0
Setembro	398	6	4	4	4	0	0	1	0
Outubro	475	5	5	2	2	1	0	0	0
Novembro	349	9	6	2	4	0	0	0	0
Dezembro	363	7	5	3	5	0	2	0	0
Janeiro	395	4	1	1	3	2	1	1	0
Fevereiro	280	3	8	0	1	1	0	0	0
Março	246	2	2	0	0	0	0	0	0
Abril	339	5	6	0	4	2	3	0	0
Maio	323	10	8	2	2	1	1	0	0
Junho	251	8	6	0	2	0	2	1	1
Total	4,179	71	60	20	32	10	15	3	1

Observações.—Pelo estudo comparativo das idades, em relação á carie dentaria e outras molestias dos dentes e seus annexos, nas observações aqui feitas, chegamos ao seguinte resultado: A idade mais critica, isto é, aquella em que mais se manifestam esses estados morbidos, é a que medeia dos 16 aos 30 annos, quer no homem quer na mulher, tendo esta um augmento sobre aquelle de 33 per cent mais ou menos. Partindo d'ahi poderemos estabelecer a seguinte média approximadamente: Dos 31 aos 40 annos ha decrescimento de 75 per cent para o homem e de 80 per cent para a mulher; dos 41 aos 50 annos ha para aquelle uma diminuição de 85 per cent e para esta de 91 per cent; quanto aos maiores de 50 annos a differença é de 89 per cent para o homem e de 95 per cent para a mulher. D'ahi conclue-se que dos 16 aos 30 annos a mulher é mais sujeita ás affecções dentarias, tornando-se o homem mais susceptivel das ditas affecções dos 31 annos em diante. Cumpre notar que nos maiores de 50 annos nas observações feitas apenas apresentam 3 comidade superior a 68 annos. Quanto ás idades inferiores a 16 annos, reservamo-las para futuras observações. Não temos a presumpção de offerecer como exactos estes dados estatisticos; elles representam apenas o começo de estudos que continuaremos com o preciso zelo e escrupulo, podendo chegar mais tarde a um resultado, senão definitivo pelo menos approximado.

ANNO COMPROMISSAL DE 1889 A 1890.

Mezes.	Consultas a.				Operações.				Receitas.
	Homens.	Mulheres.	Creanças.	Total.	Extracções.	Obturações.	Cauterisações.	Resecções.	
Julho	123	295	195	613	590	55	242	1	59
Agosto	169	210	176	555	557	75	151	0	93
Setembro	132	172	143	447	573	40	58	0	52
Outubro	125	263	188	576	601	58	153	2	44
Novembro	149	248	142	539	580	88	141	0	45
Dezembro	147	186	179	512	669	49	72	1	42
Janeiro	137	243	180	560	657	49	128	0	39
Fevereiro	147	189	168	504	583	50	101	1	56
Março	153	269	185	607	649	56	169	0	63
Abril	117	200	133	450	519	68	119	0	37
Maio	140	232	127	499	582	49	147	1	37
Junho	119	148	122	389	645	23	31	0	31
Total	1,658	2,655	1,938	6,251	7,395	660	1,511	6	598

Mezes.	Diagnosticos.								
	Carie dentaria.	Nevralgia.	Periodontite.	Stomatite.	Gengivite.	Necrose.	Fistula.	Epulide.	Luxação temporomax.
Julho	420	5	2	1	1	4	0	1	0
Agosto	331	5	3	1	2	1	0	0	0
Setembro	293	3	2	1	0	1	1	0	0
Outubro	338	3	3	1	1	1	0	0	0
Novembro	280	9	6	3	3	0	0	0	0
Dezembro	329	4	2	3	3	1	0	0	0
Janeiro	359	5	5	2	3	0	0	1	0
Fevereiro	329	4	2	0	1	1	1	1	0
Março	375	4	2	1	0	1	0	0	0
Abril	282	5	0	0	1	0	0	0	0
Maio	269	4	6	0	3	0	0	0	0
Junho	279	7	6	1	2	0	1	0	1
Total	3,884	58	39	15	20	10	3	3	1

Observações.—A proporção das pessoas matriculadas este anno neste consultorio foi a seguinte quanto a nacionalidades: Nacionaes, 71 per cent; Portuguezes, 20 per cent; italianos, 5 per cent; Hespanhoes, 1½ per cent, e 2½ per cent para as nacionalidades seguintes, guardando a mesma ordem de proporção: arabes, africanos, allemães, austriacos, paraguayos, francezes, gregos, americanos, orientaes, suecos, suissos, chins, argentinos, inglezes, turcos e hollandezes. Quanto ás idades, póde-se tomar a mêdia de 70 per cent para a idade dos 16 a 30 annos; 20 per cent dos 31 aos 40; 7 per cent dos 41 aos 55 e 3 per cent para os maiores de 51; prevalecendo em maioria as mulheres em todas as idades; divergindo das observações do anno passado neste ponto, as quaes demonstraram que a mulher era mais sujeita do que os homens ás affecções dentarias, dos 16 aos 30, dos 31 em diante, porém, tornava-se o homem mais susceptivel das referidas affecções. Como pretendemos continuar as nossas observações, sempre com todo o escrupulo, esperamos chegar a um resultado que com mais segurança nos possa fornecer dados, senão exactos, pelo menos muito approximados neste e em outros pontos de nossas observações.

SECTION XVIII.—HYGIENE, CLIMATOLOGY, DEMOGRAPHY, AND MARINE HYGIENE AND QUARANTINE.

Honorary Presidents.

Dr. Federico Puga Borne, Santiago, Chile.
Dr. Emelio R. Coni, Buenos Ayres, Argentine Republic.
Dr. Martin Dulanto, Lima, Peru.
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Dr. J. T. McGrew, Honolulu, Hawaiian Islands.
Dr. John H. Rauch, Chicago, Ill.
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Dr. Henry P. Walcott, Boston, Mass.
Dr. Irving A. Watson, Concord, N. H.

Executive President.

Dr. Albert L. Gihon, Medical Director, U. S. Navy, Washington, D. C.

Secretaries.

Dr. Peter H. Bryce (English-speaking), Toronto, Canada.
Dr. Pedro N. Arata (25 de Mayo 273), Buenos Ayres, Argentine Republic.
Dr. Luis Pierola, La Paz, Bolivia.
Dr. Pacífico Pereira, Bahia, United States of Brazil.
Dr. E. J. Rowland, New Amsterdam, British Guiana.
Dr. Gabriel Durango Borda, Bogota, Republic of Colombia.
Dr. Juan J. Flores, Heredia, Costa Rica.
Dr. Manuel Delfín, Havana, Cuba.
Dr. J. B. De Houx, Port au Prince, Haiti.
Dr. John Sundberg (Spanish-speaking), San Francisco, Cal.
Dr. Clarke, Santa Cruz, Jamaica, West Indies.
Dr. Kalmer, St. Croix, Leeward Islands, West Indies.
Dr. Encon Mora, Quezaltenango, Guatemala.
Dr. Domingo Overnaños (Chavarria 25), City of Mexico, Mexico.
Dr. Montenegro, Leon, Nicaragua.
Dr. José Arechavaleta, Montevideo, Uruguay.
Dr. Calixto Gonzales, Caracas, Venezuela.

ADDRESS BY THE PRESIDENT OF THE SECTION, ALBERT L. GIHON, A. M., M. D.,

Medical Director, U. S. Navy.

SANITARY MOTES AND BEAMS.

And why beholdest thou the mote that is in thy brother's eye, but perceivest not the beam that is in thine own eye? (St. Luke, vi, 41.)

These words of the Teacher of Humanity, which "the beloved physician" of the first century has recorded, are an appropriate text for the opening address in the important section with whose conduct I have been charged in this congress. Time was, and that no long time, when Hygeia, the neglected Cinderella of the medical family, slunk unnoticed among menials; now that she graces the salon, her proud sisters caress her and suitors court her favor. As an old admirer of this fair mistress, whose colors I have worn through youth and manhood, I may be pardoned the personal exultation that I have lived to see her *suzerain*. The ascendency of hygiene has greatened and glorified medicine, without dimming the luster of any other branch; but though her cult is established, her mission has not ended with the recognition of her supremacy and the faithful following of her own ilk. To-day she turns to the people and their rulers, outside the medical fold, and demands the place in their councils that is hers of right. A makeshift share in the administration of the sanitary interests of the country has been grudgingly allowed, but the inexorable demands of modern enlightenment can not be satisfied until the conservator of the public health shall sit a peer among the rulers. The minister of war may build mighty engines for destruction and defense and muster vast armies and navies, which disease can disperse with a weapon so tiny that the eye can not discover and no mere military expedient antagonize. The minister of finance may fill his treasure houses with gold and silver by the ton, which can buy human souls, honor, virtue, independence, everything but the boon of health, God's free gift to man, through which alone he can be like His own glorious image. Commerce, agriculture, manufacture, fishery, mining, and all the industrial occupations of the human race, which are now the objects of the intelligent supervision of cabinet ministers, who are grand masters of political economy and social science, can not thrive without vigor of human blood and brains and brawn, which are the machinery of these occupations; yet until this decade it has not been thought that the intelligent supervision of a grand master of the divine science of medicine was necessary to preserve this vigorous health of the community, without which even these other ministers can themselves only imperfectly perform their own offices of administration.

When I entered the service of the Government of the United States as an officer in the medical department of the Navy, nearly forty years ago, with a minimum of experience and a maximum of enthusiasm, and an exalted opinion of the dignity and responsibility of my charge which a lifetime has only intensified, I was astounded at the total ignorement of sanitary provision then prevailing in the naval service. Medical officers were curtly reminded that their opinions and advice would be asked when desired; their protests at acts that filled the hospitals and mortuary lists were contemptuously unheeded; they were reproved for officiousness and punished as insubordinate. Disabled sailors and marines were discharged, and their places and those of the dead were filled without regret or remorse, but with the shameless boast that "if men die we can ship others," like the Netherlands commodore, some of whose crew had been killed by the careless firing of a shotted saluting gun, who accepted the apology for the accident with the

nonchalant remark, "Dere are plenty more Dutchmens in Holland." The battle ships and cruisers of modern navies are not more unlike the brigs and sloops of war of forty years ago than are the cleanly, well-fed, comfortably clad, and cared-for enlisted men, who go on shore daily, subscribe for newspapers, and write letters, a different race from the begrimed and degraded "shell backs," who were ordered to their work with curses and punished with brutality for offenses which neglect and ill treatment had incited. The naval and military establishments have considered the beam in their own eyes, but civil authorities are still purblind to the necessity for organized intelligent sanitary supervision and direction, and grope for succor only under the flash-light of a pestilential visitation. The following from a recent editorial in an influential journal is pertinent:

Whether cholera has or has not made its appearance at Chester, which is practically one of the suburbs of Philadelphia, it is certain that the conditions reported to exist there are in the highest degree favorable for the introduction and spread of that disease. All accounts represent the neighborhood in which the alleged cases occurred as filthy beyond description and occupied by a class of persons who pay no attention whatever to the laws of health or personal cleanliness. Of course the country now has the pleasant assurance that the place is to be thoroughly cleaned and effectively quarantined; but why were not the steps necessary for the protection of the public health taken before the resulting disease, whether cholera or not, had gained such a footing that already five persons have died from it? The time to lock the stable door is before the horses housed therein are stolen, and the way to treat contagious diseases is to prevent their appearance, and not wait for them to gain a foothold and then try to stamp them out.

The secretary-general has announced that the proceedings of this section and its congener, the Section in Marine Hygiene and Quarantine, will constitute a special feature of this congress. It is therefore incumbent upon us before adjourning, to declare very positively the opinion of the members of this section, composed of experienced practical sanitarians from every country of the Western Hemisphere, that the interests of the public health must be intrusted to a department of the Government especially charged with their administration, with equal independent executive authority as given to other national departments. Temporizing legislation under the spur of emergencies does not befit this age. As the enlightened physician seeks to prevent his charges becoming ill, so should the guardian of the public health be able to forestall these emergencies, whose pecuniary cost, in money expended and wasted, in trade paralyzed and diverted, in labor and its wages lost by the sick and terrified and dead, in a single epidemic, exceeds that of maintaining an efficient sanitary service for the whole country for a whole year. The fault of the medical profession has always been its lack of bold assertion of its rights; but it can no longer hesitate to declare to trade and commerce and agriculture and manufacture that the health and vigor which are essential to prosperity can not be secured by their own unskilled, uninformed efforts. They must learn, as the military services have learned, that powerful armies and navies are the results of able and untrammeled medical departments. It is as unwise to confide the care of the national health to a financier, however astute, as to expect a postmaster-general to understandingly control a bureau of agriculture, or a fishery commissioner to best administer the affairs of the public schools, and an attorney-general to direct the mining industries. The health of a nation is a national consideration involving international coöperation. There should be no priority nor clash of sectional interests. State lines are not respected by epidemic intruders. No State barrier can be so defensive and impenetrable that the toxiferous germ can not pass through. The precise form of administration may be left to legislation, the indispensable requisites being that it shall be national, that it shall have parity of voice and influence in the national councils, that it shall have independent executive authority under the limitations common to other departments, and that it shall

be intrusted to educated and experienced medical men, who alone are competent to assume its responsibilities.[1]

I have not wandered from my text in thus pleading for a national public health establishment. Spasmodic tentative provisions in emergencies are nothing but attempts to discover *motes* from abroad when the *beams* at home should first receive consideration. To parallel further and in another sense, the scientific tendency of the day is literally toward mote hunting through microscopes instead of using our human eyes upon visible abominations. The sanitarian, official or amateur, need only look about him to be appalled at the spectacle of indifference of rich and poor, high and low, to dangers far greater than any from cholera microbes which confront them every hour, and it may be worth our while to indicate some of these beams in our own eyes, which we complacently refuse to see, while we magnify the motes on our horizon. The preventable disease, which kills more of the human race than cholera and yellow fever together, and in its ordinarily slow process of killing lessens the productive power of a community, directly by the enfeeblement of its victims and indirectly by its demands upon members of households and eleemosynary institutions for the care of these chronic invalids; tuberculosis is tolerated with as little concern as the Mongolian exhibits for smallpox or the creole for yellow fever and malaria. The consumptive, whose traits no professional acumen is required to recognize, frequents our crowded thoroughfares, sits beside us in unventilated street cars and at the hotel table, occupies Pullman sleeping births, and shares the steamship stateroom, wholly unrestrained and innocently ignorant that he or she may be sowing the seeds of disease among delicate women and children. Anyone may verify this who uses his eyes for the purpose along the railway and coastwise steamer routes to our invalid resorts. Within a twelve month, on my way to Mexico by rail, I was fellow-passenger with two invalids in the advanced stage of phthisis, en route for San Antonio, one of whom occupied the opposite berth and the other one diagonally across the car, so that I could see and hear them coughing and expectorating, with only such attention as well-intending but unskilled relatives could render. They had no vessels for receiving their sputa, which were discharged in their pocket handkerchiefs to be scattered over pillows, coverlets, and blankets. They left the car in the morning, and I saw those same berths; it is true with change of linen, sheets, and pillowcases, but with no change of blankets, mattresses, or pillows; occupied that very night by other travelers, who were thus subjected to contact with a pathogenic microbe far more tenacious of life and power of evil-doing than the dreaded cholera spirillum. One has only to sit in a crowded street car on a winter day and watch the clouds of respiratory steam circling from the mouths and nostrils of the unclean and diseased into the mouths and nostrils of the clean and healthy, as the expiratory effort of the one corresponds with the inspiratory act of the other. The road is short but straight and sure from vomica and mucous patch to the receptive nidus in another's body. Who that has ever had forced upon him an aerial feast of cabbage, onions, garlic, alcohol, tobacco, and the gastric effluvia of an old debaucheé can doubt that aqueous vapor can transport microscopic germs by the same route? Not long ago I traveled by sea from New York to Charleston, and for two nights was cabined with some twenty consumptives going to Florida. The air was chilly and they huddled around the stoves and fearfully and fearlessly closed doors and windows until the atmosphere became stifling and

[1] These propositions were unanimously adopted in the form of a resolution in these terms by the conjoined Sections in Hygiene, Climatology, and Demography, and in Marine Hygiene and Quarantine, and reported to the general session of the congress, by which it was referred to the international executive committee, which returned it with its indorsement and direction that it be transmitted as the voice of the congress to the executives of all the countries represented therein.

surcharged with their emanations and the dried sputa, which they ejected on every side. It was comparatively easy to escape during the day by staying on deck, and I slept with my stateroom windows wide open, but the curtains, carpets, pillows, and mattresses had been saturated by I know not how many expectorating predecessors. I have visited fifty smallpox cases a day, have gone through yellow-fever wards, and stood by cholera bedsides with far less apprehension than I experienced on that trip; yet it was one taken by many thousands of people who would have been terrified to know that there had been a case of cholera within a mile to leeward of their homes. Recall in your several experiences the instances of members of a family who have occupied the same chamber and bed with a gentle and beloved aunt or sister, and those of tuberculous husbands or wives, who have become ill like them with pulmonary phthisis attributed to everything but the manifest cause.

In former years I preached a crusade against another virulent communicable disease, in the interest especially of innocent and helpless women and children, and for a time I was gratified to find that husbands and fathers began to realize, from the numerous indisputable instances of innocent infection I was able to report, that syphilis might be, as it had been, contracted from combs and brushes and rough-edged drinking vessels in hotels, sleeping cars, and boarding houses, from pens, pencils, and paint brushes that had been held between diseased lips, from dirty old bank notes, from street-venders' toys, from a lover's kiss, a stranger's caress, or a nurse's ministrations. Supported by an array of cases of infected children, young girls, and elderly men and women, the committee of the American Public Health Association, of which I was chairman, advocated the enactment of a law placing venereal disease in the category of other communicable affections and punishing its transmission as a misdemeanor; but there were too many of the self-righteous blind to these beams in their eyes, who thought it wiser to seek to exterminate by ignoring its existence and never uttering the name of a disease that has done more harm to mankind than all the diphtheria, typhoid, smallpox, measles, and scarlet fever which are so carefully isolated and their statistics so regularly collected and promulgated; a disease that travels with the missionary to Asia, Africa, and the Pacific, and decimates bodies faster than he can whiten souls.

I do not expect that all who have eyes will see as I do, or, having ears, hearken to what I say. The idle and perverse generation of the first century will have its following in the twentieth, and men and women will continue to do the insanitary things they ought not to do, and leave undone the sanitary precautions they ought to take, despite our warning, our imploring, our advice, or our denunciation. However benevolent and beneficent the hygienist's aim, his unappreciated, unrequited, and often unprofitable labor is enough to deter him from what has been derisively described as only an effort to procure the survival of the unfit, and thus thwart Nature's own attempt to rid the world of them. He encounters another obstacle to success as aggravating as the disbelief in the necessity for his work. The authorities listen to his warnings, and then employ their own perfunctory and superficial methods of protection. Told that absolute cleanliness is the fundamental fact of sanitation, street cleaners are set at work brushing the surface dirt into little heaps, which passing vehicles again distribute, or the winds carry into the open windows of adjacent residences. The refuse of the household is deposited in vessels on the sidewalks of crowded thoroughfares, to be emptied after a time into collecting carts, from which clouds of dust envelop passers and circulate back into the houses; living dust, for Manfredi found an average of 761,521,000 microbes to the gram of the street dust of Naples, from which he cultivated pus, malignant edema, tetanus, tubercle, and septicæmia. Swarms of flies feed on the decomposing contents of exposed garbage pans and buckets, and carry their tiny germ-laden booty into the butcher shop of the poor and the kitchen of the millionaire. Who can dispute that if the hair of a Newfoundland

dog could transport yellow fever to a distant Mississippi town, and a newspaper printed in an Ohio village where smallpox was raging could fatally infect a United States consul in a foreign port where the disease did not exist, that a cloud of dust, a swarm of flies, or a single fly, as Sawtschenko, Simmonds, and Sternberg demonstrate, can disseminate cholera and become a focus of infection, which would have been impossible had ordinary care been exercised in preventing the exposure and promptly destroying the discharges and excreta of those already sick? Cities are reported clean whose sanitary inspectors have merely walked through crowded tenements, a hundred or more a day, and been satisfied with external evidences of brush and broom, leaving carpets and rugs unlifted; pieces of heavy furniture, with the fluff of years behind and beneath, unmoved; and closets, cupboards, pantries, storerooms, attics, and cellars undisturbed. The cellars of our great cities, and I speak with personal knowledge of many in New York, Brooklyn, and Philadelphia, are greater abominations than even filthy living apartments. The New York Herald of the 8th of August, narrating the death of two children by falling from a window on the fourth floor of a tenement at 204 West Sixty-first street, said:

> To get at the bodies of her children the frantic mother had to go through the cellar of the house. There she waded through indescribable filth, almost knee-deep, to where her children lay, when the foul odors overcame her and she fainted.

It added:

> The sanitary superintendent issued an order that the cellar must be cleaned out within twenty-four hours.

Do you believe that it was the only one of its kind that needed cleaning? No city can be accounted clean until its ordinances require every cellar door to be widely opened to sun and air, that royal pair of germicides; every cellar to be emptied of its refuse; every cellar wall and ceiling to be scraped and whitewashed; every cellar floor to be taken up if rotted, and sprinkled with lime if uncovered, a tedious and expensive process but effective sanitation, costly as it must need be, is cheap beside the outlay of a single epidemic. There are underground foulnesses in all our great cities of which they should be rid at any cost, as where ragpickers and bone gatherers collect their filthy stores and Italian street-corner fruit sellers keep their decomposing bananas, grapes, and oranges, till, rubbed off by dirty pocket handkerchiefs, they are exposed for sale, glistening after their repulsive polish with impure saliva. If some mote hunter, loath to see so huge a beam, chooses to find solace in disbelief, I might be able to shock him by declaring that I have seen the figs he munches unconcernedly flattened in their pretty boxes, in a country where syphilis reigns, by questionable thumbs moistened by equally suspicious saliva. Shall I, while revealing insanitary horrors, dare lift the sweeping train of the fair promenader, fashioned after that of women in other countries who never walk upon the streets, and show the nasty mess of spittle, excreta, mud, and dust she gathers from the sidewalks upon her white skirts and silk stockings? She will not believe me; but the bacteriologist who scoops the mud from between the cobblestones of the streets to find it swarming with microscopic life can gather as rich a harvest of microbes from these same dainty undergarments. Nor are these the only beams we overlook in our search for motes. Dr. Graham, bacteriologist of Starling Medical College, in response to an official inquiry by a member of Congress, reported that he was able to obtain thirteen colonies of two kinds of bacteria from one dirty, worn bank note, and the Medical Record of January 21 of this year states that a British bacteriologist discovered 19,000 microbes, including those of tuberculosis, diphtheria, and scarlatina, vegetating upon a single note. Other harborers of morbific germs are the textile fabrics employed in the furnishings of street cars and stages, which the chairman of the sanitary committee of the New

York board of health reports as "a menace to public health by reason of their continual exposure to uncleanness and infection from the clothing of diseased and filthy passengers," which, like their grimy bodies, may be foul with the sputa of diphtheria, tuberculosis, or syphilis, the desquamations of scarlatina, measles, or erysipelas, the emanations of typhus, or the alvine discharges of cholera or dysentery. A commendable league of zealous ladies, who are seeking to prevent the abominable practice of expectorating in public vehicles, induced a few car companies to display placards to the effect that "Gentlemen are requested not to spit on the floor," but these appeals, intended for beasts who were never gentlemen, were hung in inconspicuous places or covered by other notices, and the spitters continue to discharge their syphilitic and tubercular sputa on the floor mats, to be taken up on ladies' petticoats and carried to their homes. The spitter and the other beast who voids his impure nasal secretions where it suits him are largely responsible for the spread of influenza, for, according to Pfeiffer, the discoverer of its bacillus, "its contagium is found in the moist secretions of acute cases in the discharges from the nasal and bronchial mucous membranes."

Further detail would be out of place in an introductory address to this section. Let it suffice to point to the fragile spirillum of cholera which we are exorcising by "bell, book, and candle," as illustrating the dreaded *motes* of my text, and to the sturdy, robust bacillus of tubercle as the *beam* we will not consider. "Cholera," says Ernest Hart, "can only be drunk and eaten. It can not be caught and breathed;" but the tubercular mischief-maker, who finds the ever-open door of the respiratory passages his readiest approach, may also enter at any or all the orifices of the body. Among 1,000 autopsies, Osler found 275 with tuberculosis; among 8,873 patients in the surgical clinic at Würzburg, one-seventh (1,227) were tuberculous; the necroscopic statistics of Harris and others "show that one-third, perhaps over one-half, of the people who live to middle age have some form of tubercular infection;" and Dr. Williams, of Johns Hopkins Hospital, estimates that tuberculosis of the female generative organs is four times more frequent than generally supposed (Medical Record, March 18). Can any more obvious method of direct infection in these cases be imagined than the trailing skirts of women gathering tubercular sputa from the pavements?

The sanitary inspector is destined to become the most important agent of future civic administration. The perfunctory burning of a pan of sulphur in a diphtheritic chamber, the sprinkling here and there of a solution of corrosive sublimate, or the substitution of the sweeter scent of thymol, pinol, or some newer "ol" for the foul odor of the privy, will not then be the tolerated limit of his interference. All that science teaches and all that intelligence can devise will be exacted of him. A sanitary inspection will be a deliberate, painstaking, critical examination of nooks and corners and their disinfection, the flooding of the lairs of microscopic motes, and the deluging of unsightly beams with those unstoppled, unpatented, inexhaustible germicides; air and sunshine.

Coincident with the approaching Eleventh International Medical Congress at Rome and its fitting complement there is to be an exposition of medicine and hygiene, and significant of the share accorded sanitary science in a medical congress representing the highest modern professional attainment, it will be noticed that of the ten classes which, in their *ensemble*, make up the exposition, five are exclusively hygienic, to wit, (4) plans, models, and *matériel* bearing on school management and sanitary civic organization (*riordinamento urbano*); (6) plans, models, and *matériel* for hygienic constructions; (7) apparatus and furniture for hygienic uses in the interior of common dwelling houses and public offices on every scale; (8 *matériel*, appliances, and accommodations for the practice of personal hygiene, and (9) plans, models, and appliances for the hygiene of the working classes. Three are partly hygienic, to wit, (1) apparatus, *matériel*, and plans of buildings

for scientific and technical investigation in therapeutics, biology, and hygiene; (3) articles and appurtenances requisite in salvage service and in *assistance publique;* and (10) books, atlases, photographs, and such like recently published and having reference to the medical, biologic, and hygienic sciences. Two only of the ten are exclusively medical and surgical, to wit, (2) apparatus, instruments, and *matériel thérapeutique* in the various departments of medicine, and (5) plans, apparatus, and furniture for the purposes of the divisional surgeon in cities. Additional to these, special classes are devoted to hydrology and balneo-therapy, and to the Italian Red Cross Society, both of which are practical outcomes of sanitary endeavor.

I do not forget that climatology and demography, as well as hygiene, are within the purview of this section; but what are climatology and climatotherapy but applied hygiene, and what is demography but the demonstration of the results of sanitary or insanitary conditions among masses of people? The climatologist is of necessity a hygiologist. The materia medica and pharmacopœia are not his text-books. Physical geography, meteorology, hydrology, balneology are his scriptures and gospels; the vivifying light, invigorating air, and healing springs and waters his armamenta—his anodynes and hypnotics, his roborants and eutrophics, his alterants and excernents. The high professional standing of the American Climatological Association, one of the constituent bodies of the Congress of American Physicians and Surgeons, and the distinguished climatologists who are with us to-day and who are conspicuous in every international congress of hygiene, are evidences of the place in medicine of climatotherapy, the practical end of medical climatology—that broad specialty which robs so many graves of untimely victims and makes so many, heretofore without hope, able, if not to take up their beds, at least to get out of them and walk. The field of the climatologist is as broad as the habitable surface of the globe—in the high altitudes of Colorado and the Alps; in the odorous pine forests of Norway and the Carolinas; on the seashore or upon the wide waste of waters and their islet oases swept by ocean breezes.

Our American vital statistics are not yet piled high enough to form the foundation for a substantial superstructure of demography. The great cauldron in which we are mixing Celts and Saxons, Semites and Aryans, with a seasoning of syphilis, tuberculosis, and insanity, is simmering with what ultimate homogeneity can only be conjectured. When immigration was a tiny stream, however muddy and noisome, poured into a rapid river of pure water, it was soon lost in the crystal fluid; but now that huge sewers are discharging their fœtid pestilential torrents into a placid lake that has no outlet, the lake itself becomes turbid and unclean. Already in the *culs de sac*, which are nearest the open mouths of these foul sewers and receive their floating scum—the prisons, reformatories, almshouses, insane asylums, and hospitals—this filthy, debased, and diseased foreign element is ascendant, and our demographers have a simple task in representing its volume by numerical statistics. Dr. Frederick H. Wines, the distinguished compiler of this portion of the census of the United States for 1890, demonstrates by the indisputable evidence of figures that while the foreign born constitute only 17 per cent of our total white population—in round numbers about one-sixth—yet they furnish over half of all the paupers in the almshouses of the country. It is evident that the traits of the Saxon are disappearing from our national complexion, and if the proper solution of the negro question be, as suggested by certain prominent Afro-Americans, to bleach it out by admixture, we may expect the hue of our descendants to be decidedly tawny.

The most zealous demographers of this decade are the French, who have been spurred in their statistical researches to discover the causes of the too evident depopulation of France of its native races, but are we not again refusing to

consider the beam in our own eyes in not giving heed to the operation of similar conditions in our own country? Dr. Billings announces that our birth rate has fallen from 36 in 1,000 inhabitants in 1880 to 31 in 1,000 in 1890. The 20 to 30 children of our ancestors, the dozen or more of our great-grandmothers, have dwindled progressively to 5 or 6, then to 3 or 4, until to-day 1 or 2 or none represents the fecundity of the educated classes. The Independent, referring to New England Puritan life, says:

Large families abounded. According to Cotton Mather, one woman had 22 children and another 23 by one husband, and a third was mother to seven and twenty. Sir William Phipps was one of 26 children of the same mother. Printer Green had 30. The Rev. John Sherman, of Watertown, had 26 children by two wives, the second spouse the mother of 20. The Rev. Samuel Willard, first minister of Groton, had 20 children, being himself one of 17, as was Benjamin Franklin.

The paragraphist who can now record the case of the woman of 31, at Cold Spring, who has become the mother of 17 children in nine years, or that of the Georgia matron of 25 who rejoices in 13, has, in newspaper parlance, "a great find." The spectacle of impending maternity among our better classes is becoming more and more rare, and still more rare that of an infant nursing at its mother's breast. Only in the squalid quarters and *banlieues* of our great cities, where the English language is not spoken among imported lazzaroni and the overflow of European ghettos, does the process of human incubation go on as God and nature intended. The laws of creation are immutable, and one has only to look beneath the disfigurement of female dress to recognize the evidences of imperfect physical development—in stooping, unsymmetrical shoulders, in meager limbs, in narrow pelves, and flattened busts.

Dr. Otis exhibited at the recent meeting of the American Climatological Association, in illustration of diametric measurements of the thorax, the profiles of a number of female chests, which were supposed to be those of little girls, until he explained that they were the contours of nubile young women in Boston normal schools, like her whom Solomon bewailed in the song of songs, "We have a little sister, and she hath no breasts. What shall we do for our little sister in the day when she shall be spoken for?" My friend Dr. Robert T. Morris, of New York, has significantly called attention to the fact that 80 per cent of all Aryan American women have rudimentary clitorides, and he asks if evolution is trying to do away with this organ in the degenerative changes characteristic of highly civilized varieties of the *Homo sapiens*, of which early falling hair, decaying teeth, weak mammary glands, and badly balanced eye muscles are other examples. Is the sexual instinct losing its potency as a maternal factor? Is marriage only a social office for the display of finery on the brides and bridesmaids and the entertainment of crowds of gaping strangers? Is the virgin wife best prepared for conception by months of preliminary surexcitation and feverish anxiety, and is a fatiguing railroad journey the best prelude to an act which should lead to the inception of a human being—the incarnation of a human soul? Has the function of reproduction come to be regarded only as a bestial and undesirable concomitant of matrimony and lactation its vulgar, indecent supplement, and is all this attributable to physical deterioration shown by the undeveloped or imprisoned *mentula muliebris* and atrophied mammæ, and how far is this the explanation of the diminished fecundity of the Aryan American woman? These are problems as interesting to our demographers as the depopulation of France, the disappearance of South Sea Islanders, the migration of Semitic and Mongolian races, and the effects of malnutrition of indigenes of Ireland and Russia.

But, gentlemen, I shall no longer trench upon time that belongs to you. I am highly gratified at your presence, and thank you most cordially for your kind attention.

The remainder of the address was delivered in Spanish, of which the following is a translation:

GENTLEMEN, OUR FRIENDS AND COLLEAGUES FROM ABROAD: Permit me, on the part of the members of this section from the United States of America, to tender you a most hearty welcome to our capital. Your long travel to this city bespeaks your interest in the occasion. It is no light boast that here, for the first time in its history, the medical profession of all America finds itself united in one great congress. It was about nine years ago that a number of Canadian sanitarians claimed the right as Americans to become members of the American Public Health Association, and it was my privilege as president of that body to receive them as such. The subsequent transactions of that association show how loyal they have been to its traditions, how zealously they have participated in its work, and with what dignity they have filled its highest offices. Two years later they carried the association into their own territory at Toronto. In 1890 two distinguished representatives of the superior council of health of our sister Republic of Mexico came to Charleston and, as Americans, likewise knocked at the door of the American Public Health Association, returning the following year in such numbers and with such a hearty welcome from their Government to meet in their own capital that the invitation was accepted, and the most successful meeting of that association, the twentieth in its history, was held in the ancient city of the Toltecs. To-day the roll of States represented in the advisory council shows Illinois, Massachusetts, and Tennessee; Ontario, Quebec, and Manitoba; Guanajuato, Querétaro, and Zacatecas in one fraternal union. What sanitarians have done in that association, which bears the escutcheons of its three constituent countries side by side, this congress aims to accomplish for the whole profession of medicine in the Western Hemisphere, uniting its members in one brotherhood, whatever their race or language, and whether their homes be on the frozen shores of the Arctic or the hillsides of Terra del Fuego, among Greenland's icy mountains, in the archipelago of the West Indies, or amid the perennial gardens of Hawaii. Physicians and brothers from the United States of all America, welcome to this your capital, which, in that sweetest language spoken by human tongues, *ponemos á vuestra disposición.*

PROCEEDINGS.

FIRST SESSION.

TUESDAY, *September 5, 1893.*

The proceedings of the section were opened promptly by the president, Albert L. Gihon, medical director, United States Navy.

Dr. A. Nelson Bell, of Brooklyn, the senior honorary president of the section, then took the chair, while the president delivered his opening address.

On motion, the address was referred to the committee on publication.

Dr. Walter Wyman, Supervising Surgeon-General Marine-Hospital Service, being absent, the paper of Prof. Cornelius G. Comegys, of Cincinnati, Ohio, "On the proper status of the medical profession in the government of nations," was read.

After the reading of the paper, Dr. Atkinson, of Philadelphia, offered a resolution looking to the organization of a national department of health, which was seconded by Dr. Davis, of Philadelphia, and subsequently modified, with the mover's sanction, by the president, in the terms of his address, as follows:

Resolved, That in the opinion of the Section of Hygiene, Climatology, and Demography of the Pan-American Medical Congress the interests of the public health in every country should be and must be intrusted to a department of the Government especially charged with their administration, and that, while the precise form of administration may be left to legislation, the indispensable requisites are that it shall be national, that it shall have parity of voice and influence in the national council, that it shall have independent executive authority under the limitations common to other departments, and that it shall be intrusted to educated and experienced medical men, who alone are competent to assume its responsibilities.

Discussion on the resolution was opened by Dr. James F. Hibberd, of Richmond, Ind., president of the American Medical Association, who said: All the results of all activity in physics are the product of laws, God's laws; and we shall not be able to modify these results and direct them to the happiness of the human family until we study and understand these laws. Science is nothing more, nothing less, than an investigation of the laws of nature, and while we may stumble on knowledge that will be useful to us, the only way we can progress rapidly and profitably is to devote ourselves earnestly and continuously to scientific investigations. Much has been done by individual pursuit of science; more has been done by aggregations of people organized to further this investigation, and it must be an axiomatic proposition that the more persons and the more completely they are organized, and the better equipped with both power and means to push such investigations, the more speedy and the more valuable will be the results. Certainly in the United States there is no organization that approximates the power or the means of the Government itself to carry on these measures, and, consequently, there can be no question that it is the privilege, if not the duty, of this section to urge upon the Government of the United States to inaugurate an organization clothed with authority and supplied with means to make exhaustive cultivation of sanitary science and apply the result to the welfare and happiness of the people, which is the very highest function of government.

Dr. Felix Formento, of New Orleans, La., president of the State board of health of Louisiana, said: I suppose I am called upon by our honorable chairman because, in a spirit of justice and fairness, he wishes all the sides of the question to be presented. I can not indorse *in toto* the adoption of the resolution just presented. I am in favor of a bureau or department of health, provided the creation of this

bureau does not carry with it all the possible consequences implied and understood. As a delegate of the State of Louisiana and a representative of the Louisiana board of health I can hardly be expected to indorse such a resolution. I am in favor of a bureau of health the duties of which will be well defined. By means of the representatives of the Government abroad and the powerful means at their command it should be informed of the exact sanitary condition of every State in the Union and every country in the world, and keep all sanitary authorities in the United States fully informed of the same. It should gather vital statistics and make a thorough study, through its experts, of epidemic diseases, demography, etc. But it should not interfere in those States having a good system of quarantine and which have demonstrated by years of experience that they are fully able to protect themselves, and, in protecting themselves, protect the neighboring States. Louisiana, my native State, has fully demonstrated that she is entirely able to protect her citizens. She has the best system of quarantine in existence—a system which has been copied by the Federal Government and by other States. We have proved that yellow fever does not belong to our soil. It is a foreign disease, which an efficient system of quarantine will keep out of our country. For the last fourteen years yellow fever, which existed every year in our city, has not made its appearance in New Orleans, while there has not passed a single summer without cases of yellow fever occurring at our quarantine station. Louisiana has shown what she could do in this matter, and that without any assistance from the General Government. If each State protected itself as well, as it should do, there would be no necessity for any interference on the part of the Government. I am afraid that politics will greatly influence the formation of any such bureau. There might be possible discrimination between cities and cities, determined by commercial interests and influences. Besides, the same rules and regulations will not apply to all parts of the country. Those best qualified and able to protect themselves and their citizens are those who live and own all they possess in the threatened localities. I believe the Louisiana State board of health will better protect their people than any bureau in Washington. They are personally interested in this question. In addition to the scientific duties to be performed by it, this bureau of health might establish a standard which will govern the establishment of quarantine in those States which do not now have an efficient system. The resolution offered might go further than we wish to go.

Dr. John W. Trader, of Sedalia, Mo., said: I would like, Mr. Chairman, to have this resolution lay over until some hour on to-morrow. I would like to speak upon this subject, and, on account of the importance of the question, would like to have more time. I believe that we should have well-organized health laws that would have a uniform action over the whole country. To have a variety of laws enacted in the various States without a national uniformity would operate something like our divorce laws. What one State binds together another State divorces. We have had some experience in this clashing of authority. The fear expressed by some of establishing a Cabinet officer to preside over all sanitary matters in all the States can be removed by making this office appointive by the medical associations and scientific bodies, and not by Presidents or governors or judges who are not medical men. Whatever action is taken should look to a uniformity of all sanitary laws, operating alike in all States, cities, or municipalities.

Dr. S. F. Davis, president of the State board of health of Pennsylvania, said: Object lessons are used by the most notable educators to impress upon their pupils most readily and permanently important facts. I have no better argument to offer than to call your attention to the work done by Surg. Gen. Walter Wyman, of the Marine-Hospital Service. A better and more complete quarantine cordon could hardly be organized than now exists, showing, satisfactorily to my mind, that a national head, assisted by the various State boards, is the proper and only perfect plan to further the interest of preventive medicine.

Dr. Grant (Bey), of Cairo, Egypt, favored the idea of having the public health department represented in Congress. He said that England was feeling its way toward having a public health minister. For many years she has had a local government (sanitary) board which has furnished the information necessary to ministers ignorant of sanitary science when commercial and sanitary questions are on the carpet and laws dealing with these questions have to be passed. Much better would it be for ministers to have one of their number to guide them in these matters, and if the United States carries such a measure it will have dethroned England from the high position she now holds in all sanitary matters.

Dr. Charles O. Probst, of Columbus, Ohio, secretary of the State board of health of Ohio, said: Ohio desires to place herself on record as in favor of a national department of health. A resolution to this effect was adopted by our State board of health, which was indorsed by nearly every municipal board of health in the State. These resolutions were furnished to our members of Congress, and they were urged to support a bill for a national board of health. In establishing this department with a Cabinet officer at the head, we should keep in mind the fact that this officer will be subject to change every four years. This, in my judgment, makes it inadvisable to have its head in the Cabinet. Such an officer should be as little subject to political removal as possible.

Dr. Benjamin Lee, secretary of the State board of health of Pennsylvania, said: This question has been discussed from several points of view. It is a many-sided one. We have had it treated from the point of view of the traveller. I wish to say that, notwithstanding the perils depicted by one of the speakers, I propose to go home, and to do it without fear, and yet I am not sorry that my home is so near that I shall not be compelled to occupy that abomination, a sleeping car. On the kissing question I decline to commit myself too strongly. As regards seacoast quarantine, while there are, of course, objections on the part of those who are interested in local quarantine to any interference with their work on the part of the National Government, I am willing to say that for the sake of having a national health department, so far as the State board of health of Pennsylvania is concerned, we should be willing to be somewhat shorn of our own prerogatives. The question seems to be not, "Shall we have a national health authority?"—this we are all agreed would be desirable—but, "Shall this authority be a department or a board?" We have had a board and it has failed. From conditions of weakness inherent in itself it has fallen to pieces. Whether from local jealousies or outside influences it matters not. Now, let us try the other alternative and have a department, equal in power and respectability to any other Department of the Government.

Dr. Edward O. Shakespeare, of Philadelphia, Pa., said: I am in full accord with the broad principle expressed by this resolution, however I may doubt the policy at the present moment of recommending some details. Some of the objections raised by the representative of the Louisiana State board of health to national control of sanitation, it seems to me, are not founded upon a tenable basis. While local, municipal, and State governments have undoubtedly the inherent right to protect their own local territory against the causes of disease localized within their own limits, they have also equally the right to insist that their safety shall be secured against the dangers assailing from without. This is tantamount to denying the right of any municipality or State to so regulate or neglect to regulate its local sanitation in such a manner as that neighboring or even distant governments may be jeopardized. The State of Louisiana, fortunately for herself and for the whole country, has at the present time one of the most perfect sanitary organizations and establishments in the whole world so far as concerns quarantine against introduction of contagious disease by sea. But this gratifying state of affairs in Louisiana has not always existed. In fact, the present perfection and efficiency of the quar-

antine at New Orleans have sprung up within a few years, thanks to the wise, energetic labors of Dr. Holt, spurred on by the constant demands of the inhabitants of the whole Mississippi Valley beyond that State. I can not agree with the claim that no one outside of Louisiana, namely, the whole people of the United States, has a right to interfere with the right of that State in matters of quarantining. How the New Orleans quarantine is now regulated or may be in the future is something which this whole North American population has an inherent right to so supervise and control that whatever else may be done at the quarantine establishments at the mouth of the Mississippi, they shall, by their national laws, administered by their national officers, see to it that the rest of the country shall be efficiently and always protected. The operations of a national department of health need no more interfere with or abrogate the rights and duties of the State boards of health to effectively guard the citizens within the State than any department of the General Government now existing interferes with the local enactment and local administration of local laws or the existence of a national department of agriculture and a national department of law abrogates or interferes with the existence or functions of a State board of agriculture or of a State code of laws.

Dr. J. G. Hopkins, of Thomasville, Ga., said: As the representative of Georgia I wish to say that I think I voice the sentiment of that State when I say that I am in favor of this resolution. I blush to state that our legislative halls are annually filled with "hayseeds" who do not appreciate the importance of such; hence we have no State board of health. It is necessary that we have protection, and we think it but right that it come from the National Government.

Dr. Lawrence F. Flick, of Philadelphia, Pa., said: The question of sanitary science is a complicated one, and ought to be carefully studied before any practical measures are considered or recommended. The question implies legislation as well as execution. In our American system of government we have United States, State, city, and borough legislation. We accordingly ought to have United States, State, city, and borough executive officers. We must have legislation on medical matters not only in the United States but in States, cities, and boroughs, and we ought to have executive officers representing these various governments to enforce them. We should have a Cabinet officer for the United States, but we should also have State, city, and borough executive officers. The resolution recommends action on the part of the United States, which is a good beginning, and it ought to be adopted.

Dr. W. O. Daniel, of Georgia, said: I think we ought to have a national health department. In the absence of a State board of health in Georgia we have more than once been compelled to call upon the Federal Government to aid us in stamping out infectious and contagious diseases in Georgia. I think, too, that each State should control her department, except in general coast quarantine, as perhaps a standard that would be suitable for Pennsylvania would not be suitable for Louisiana. We are very proud of our State, but ashamed to acknowledge that we have no board of health. We are delighted, however, to be able to furnish to the United States the present Speaker of the House of Representatives. We hope soon to be able to thoroughly sanitate our State through the efforts of a State board of health.

Dr. L. P. Mullineux, of Astoria, Oreg., said: Sir, I favor this resolution because I believe it is the duty of this Government to care for the public health. If the people should care for the health of the country, it does not follow that the States will cease to care for its citizens. But, sir, it will strengthen the hands of the States, and where there is no State law it will be the cause of having law. Go, sir, to the Weather Bureau and see the detail work they have there. All parts of

the country are reached in a few hours. Then, sir, it will take the public health out of politics, and where they have trouble the Government will then have the power to settle all disputes. Now, sir, the health officers of almost all cities are the creatures of politics, and often, sir, they are unfit for the positions. Then, sir, we have parts of the country where State laws can not reach. I do hope, sir, that this section will favor this resolution.

Dr. J. S. Kelley, health commissioner, of Minneapolis, Minn., said: Representing, as I do, the great North Star State, the State of Minnesota, which is more interested in a national quarantine system than any other section of our country, receiving yearly thousands of immigrants, and located upon the great northern railroad systems carrying them farther into the interior, I therefore desire to be placed upon record as favoring the resolution.

Dr. William P. Lawler, of Lowell, Mass., said: I wish to add my approval to the resolution offered by the learned gentleman of Philadelphia. Much has been said about the importance of the preservation of public health. I will not dwell any longer on that point, but I look upon the establishment of a national department of health as a matter of real necessity. Under the present state of affairs there is always a danger of clashing between municipal boards of health and State sanitary commissions. In some States there are no boards of health; in others the rules and regulations are very meager and very imperfectly carried out. Now, by the establishment of a national health department we shall establish a body having such an executive authority that it will be able not only to arbitrate but dictate and command on all occasions where the public health and safety demand. The action of different departments of New York and the friction that occurred between them on the subject of quarantine are too recent to require any further mention. Some of the gentlemen who preceded me, and who appear to be a little conservative, seem to be inclined to regard this resolution as too radical. Well, Mr. Chairman, it is radical; and it is necessary that it should be radical. This subject has got to be treated from the very root. There is no half-way method about it. Let an epidemic of smallpox or yellow fever break out in one city or State and spread to a neighboring city or State, and no rules nor regulations can be mutually agreed upon between the health authorities of these respective localities; think of the irreparable losses that might follow while the conflicting sanitary officers would be parleying over questions of isolation, disinfection, and quarantine. The result is but too evident. The resolution now before the house does away with the possibility of any such peril. Another speaker is inclined to think that it would be inexpedient to bring such a sweeping resolution before Congress. Gentlemen, I hold that it is our duty to bring this question to a focus. It is our duty in congress here assembled to seek legislation on this subject, and to have laws passed that will cover the regulations of sanitation in all sections of the country. With yellow fever threatening us on the one side, and cholera staring us in the face on the other, I can not see how the National Government could disregard the appeal of this representative body. However, gentlemen, should Congress repudiate our request, then the responsibility will not be ours, and we shall have the consolation of knowing that we did our duty.

After the above discussion, Dr. Frederick Montizambert, of Quebec, Canada, honorary president of the section, being in the chair, Dr. Gihon offered the substitute as above given for the resolution of Dr. Atkinson, which was accepted by the latter and unanimously adopted by the section.

On adoption the resolution was referred to the congress in general session; was reported to the congress Wednesday, September 6, and referred to the international executive committee, and reported back approved, with instructions to communicate it to the executives of all the countries represented in the congress.

Dr. J. G. Hopkins, of Thomasville, Ga., moved the following resolution, seconded by Dr. Flick, of Philadelphia:

That it is the sense of this body that it is the duty of every State not already provided with exact laws providing for the establishment of a State board of health to provide the same.

Carried.

The following paper was then read: "Ojeada Retrospectiva Sobre la Organización de la Sanidad de los Ejércitos Españoles—Primeros Albores de la Medicina Militar en América," by Dr. Felix Estrada y Catoyra del Ejército de la Isla de Cuba.

The section adjourned.

SECOND SESSION.

WEDNESDAY, *September 6, 1893.*

The meeting opened at 11:15 A. M., Dr. Frederick Montizambert, of Quebec, honorary president of the section, in the chair.

Dr. James Cecil Phillippo, of Kingston, Jamaica, British West Indies, read a paper on "The Climate, Hygiene, and Demography of Jamaica."

The paper by Dr. James H. Clarke, of Jamaica, on "The Climate of Santa Cruz Mountains" was thereafter read by title, and ordered to be printed.

Dr. Wolfred Nelson, of the city of New York, read a paper on "The Three Climates of Jamaica; its Coast or Tropical, Temperate, and Moderate Climates; Jamaica Regarded as a Winter Island for Health."

"Les Mesures Prophylactiques contre les Epidemies," by Dr. J. B. Lacerda, of Rio de Janeiro, Brazil, was read by title.

This was followed by Dr. Eduardo Liceaga, Presidente del Consejo Superior de Salubridad del Distrito Federal de México, on "Qué Bases Generales Podían Proponerse á los Diversos Gobiernos del Continente Americano Para Hacer Uniforme y Eficáz la Policia Sanitaria Marítima Internacional."

Dr. J. A. S. Grant (Bey), of Cairo, Egypt, read a paper on "The Climate of Egypt in Geological, Prehistoric, and Ancient Historic Times."

The paper by John C. Sundberg, consul for the United States of America at Bagdad, Asiatic Turkey, on "The Climatology and Demography of Mesopotamia" was read by title, and ordered to be printed, as were also the following: "Hygiene de Monterey" by Dr. Fermín Martinez, Monterey, México; "Apuntes Sobre la Patología del Departemento Fluvial de Loreto," by Dr. Leónidas Avendano, Lima, Perú.

The section then adjourned.

THIRD SESSION.

WEDNESDAY, *September 6, 1893.*

The section met at 3 P. M., the president in the chair.

Dr. George Homan, commissioner of health of St. Louis, Mo., read a paper on "Municipal Sanitation in St. Louis." It was followed by a paper by Dr. Domingo Orvañanos, secretary of the superior board of health of Mexico, on "Causas y Modos de la Propagación de la Neumonía Lobar Aguda."

Discussion on the papers already read being opened, Dr. John H. Rauch, Illinois, presented a resolution recommending that on account of Asiatic cholera in Europe immigration be restricted.

Discussion on the resolution took place and was participated in by Dr. James A. Stewart, health officer of Baltimore; Dr. Shakespeare, Philadelphia; Dr. Kelley, of Minneapolis, Minn., and others. Amongst these:

Dr. Lee, secretary State board of health of Pennsylvania, Philadelphia, said: I desire to go on record as in favor of restricting immigration from places or ports in which cholera prevails. At the same time it occurs to me that the resolution needs modification. We should specify a little more definitely what we mean by the prevalence of cholera. Shall we say that because during the past two weeks there have been several cases of cholera in England cholera is prevalent in that country, and we shall therefore suspend immigration from Great Britain? Further, the resolution is based upon economic as well as sanitary grounds. Now, I take it that neither this section of hygiene, nor the congress of which it forms a part, has anything to do with economic questions. Whatever we may think as individuals as to the expediency of limiting immigration, from a financial standpoint, especially during our present perturbed condition commercially, we as a sanitary body should be going entirely out of our province in making suggestions on that ground.

Dr. Lawrence F. Flick, Philadelphia, said: The resolution as offered is objectionable for the two reasons called attention to by Dr. Lee. The principle employed, however, namely, that immigration from countries in which cholera prevails should be stopped, will meet with the approval of all. We might adopt the resolution so amended as to leave out the objectionable features.

Dr. Cyrus Edson, commissioner of health of the city of New York, said: I hope this resolution will receive the indorsement of this section and of the Pan-American Medical Congress. I believe that an expression of opinion on the subject in question, in the manner that this is expressed, will certainly result in stoppage of a traffic that is in the highest degree dangerous to the well being of the various countries represented in this gathering. In my opinion it is not possible to maintain a quarantine against Asiatic cholera that will be certain and sure of successful results. I say this with all respect and deference to my colleague, Dr. Jenkins, the health officer of the port of New York, who, I know, does not agree with my opinion. I believe, and no one has had closer opportunity for forming judgment, that Dr. Jenkins's quarantine is as ably administered as that of any other port in the world. His work this year in connection with the cholera steamship *Karamania* is worthy of our highest commendation; nevertheless, neither Dr. Jenkins nor any other man can to a certainty keep cholera out of this country when the disease is on shipboard within one of our ports. Our experience of last year has led me, and it must also lead others, to this conclusion. Last year cholera appeared in the lower bay of New York Harbor, and within fourteen days nine authenticated cases of the disease were in the city of New York. This year, following the arrival of a cholera-infected ship, a case declared to be cholera by such men as Biggs, Kinyoun, Park, and Prudden appears in Jersey City. I believe that the disease in these instances can be accounted for in only one way, and that is through the medium of fly infection. Careful experiments have proven that the house fly can carry on his feet and in his body the spirillum of cholera, and that the spirilli thus carried will remain active for several days. A fly is a most rapid flyer, and can traverse the entire length of Manhattan Island within fifteen minutes. A fly may infect itself by contact with cholera dejecta in the lower bay and carry his load to a fertile soil in the heart of the city within a short time. I believe in this theory of fly infection, because it has been proven; believing it, I can not believe that cholera can be successfully quarantined. The temporary stoppage of emigration from infected countries will work no harm to any interests at this time except those of the steamship companies. It is the safest and best course for the welfare of the many. We may not be able to agree upon the ground of expe-

diency or science in this matter, but there can be no two opinions concerning the efficiency of the proposition to the end that cholera be kept out. The consequences that will follow should it gain a foothold in our small towns will be so disastrous that if we err at all in our fight against it, our mistake should be on the side of public safety. It has been said that this measure is a political one, and that it has no place in a scientific gathering of the character of the Pan-American Medical Congress. This is not the view for us to take. Science, religion, and politics are to-day so closely interlocked that they can not be considered separately. The section on hygiene is the connecting link between the Pan-American Medical Congress and the body politic. We hygienists are and must be in touch with public questions that affect the lives and health of communities. We must be in the highest sense of the word politicians. If you refuse to consider this great public question through fear of politics, then your fear of politics should lead you to banish public hygiene from the sections of your congress.

After a very full discussion the resolution of Dr. Rauch, amended by a committee appointed by the president and consisting of Dr. Edson, New York; Dr. Shakespeare, Philadelphia; and Dr. Lee, Philadelphia, was unanimously adopted by the section.

The resolution is as follows:

Resolved, That it is the sense of the section on hygiene, climatology, and demography that in view of the prevalence of Asiatic cholera in Europe at the present time and the constantly increasing number of foci of infection, immigration from European countries in which cholera exists should be temporarily suspended, as this action affords, in our opinion, the only certain means of averting a threatened invasion of the disease of the countries of the American continent.

Be it further resolved, That this resolution be reported to the general session of the Pan-American Medical Congress with a request for its adoption and speedy transmittal to the executives of the several countries officially represented therein.

It was further moved by Dr. Ruggles, president of the State board of health of California, seconded by Dr. Flick, of Philadelphia, and resolved by the section on hygiene, climatology, and demography that "the Congress of the United States of America be most earnestly requested to cause a large edition of the very valuable report of Dr. Edward O. Shakespeare, of Philadelphia, of his researches in cholera to be printed for distribution among the several countries represented in the Pan-American Medical Congress."

Carried.

Dr. James M. Postle, Hinckley, Ill., then read a paper "On the Need of Research in Preventive Medicine." This was followed by a paper "On Schools in Relation to the Spread of Diphtheria," by Peter H. Bryce, M. A., M. D., of Toronto, secretary provincial board of health of Ontario, Canada.

The meeting then adjourned.

FOURTH SESSION.

THURSDAY, *September 7, 1893.*

The section met at 11 A. M., the president in the chair.

A paper was read by Dr. Jesús E. Monjarás, of San Luis Potosí, Mexico, entitled "Medidas que Deben Tomarse para Impedir el Desarrollo de las Enfermedades Transmisibles en las Ciudades."

The next paper which was read by title was "On the Early Detection of Phthisis, Including the Author's Contributions to Diagnostic Means; with a few Considerations of a Possible Pretubercular Stage," by Charles Denison, A. M., M. D., of Denver, Colo.

Thereafter Dr. Lawrence F. Flick, of Philadelphia, Pa., read a paper "On Practical Measures for the Prevention of Tuberculosis."

A paper by K. von Ruck, Asheville, N. C., on "The Climate of Western North Carolina, with a Consideration of the Relative Values of High and Medium Altitudes on the Treatment of Pulmonary Tuberculosis," was read by title. This was followed by a paper by Dr. G. Farrar Patton, New Orleans, La., on "Suggestions for a Plan to Enable the Masters of Merchant Vessels to Properly Care for Those Attacked at Sea with Yellow Fever," and by a paper "On Isthmian Practices with Regard to Burial of Dead," by Dr. Wolfred Nelson, of New York.

Dr. Juan J. Ulloa, of Costa Rica, read a paper on "Observations on the Convenience of Establishing a Uniform American International System of Quarantine and American Hygiene."

The following resolution was then adopted:

Resolved, That the Pan-American Medical Congress considers of the utmost importance as great a uniformity as practicable of laws and regulations concerning maritime hygiene and quarantine for all countries of America; and hopes that the United States Government will initiate a movement in this direction by calling a meeting at some early date of delegates sufficiently authorized by the several American countries, whose object would be the study of the whole question of maritime hygiene and quarantine, as well as international sanitation as they are especially related to the conditions prevailing over the American Hemisphere and adjacent isles.

Resolved, That the foregoing resolution be reported to the general session of the Pan-American Medical Congress, with a request for its adoption, and, in such case, thereafter transmitted to the executives of the several countries represented in this congress.

Dr. Benjamin Lee, of Philadelphia, secretary State board of health, Pennsylvania, then read a paper entitled "Does the Presence of Leprosy in the United States of America, Canada, and Mexico Call for the Supervision of their Several Federal Governments?"

The session then adjourned.

FIFTH SESSION.

THURSDAY, *September 7, 1893.*

The section met at 3 P. M., Dr. Formento, of New Orleans, honorary president, in the chair.

A paper was read by Dr. Beaven Rake, medical superintendent of the Leper Asylum, island of Trinidad, British West Indies, late member of the Indian Leprosy Commission, "On the Communicability of leprosy."

A discussion on these papers was participated in by Dr. Nelson, of New York; Dr. Shakespeare, of Philadelphia, and Dr. Carter.

Dr. Lee replied in the discussion and moved the following resolution, which was lost:

Resolved, That it is the sense of the section on hygiene, climatology, and demography that the prevalence of leprosy in British America, the United States of America, and the Republic of Mexico is such as to make it a proper subject for the attention of the federal governments of these countries.

Resolved, That this resolution be transmitted to the general session of the congress for its consideration.

The following papers were then presented by Dr. Prosper de Pietra Santa, de St. Cloud, France, Rédacteur du Journal D'Hygiene de Paris, on "L'eau de Seltz à Paris—Historique du Siphon—Gazéification par l'Acide Carbonique Liquide;" and on "El Bocio en la America del Sud," by Dr. Samuel Gache, of Buenos Ayres, Republica Argentina.

The following resolution, moved by Dr. Charles A. Probst, secretary of the State board of health of Ohio, seconded by Dr. Ruggles, president of the State board of health of California, was offered:

Resolved, That it is the belief of the section on hygiene, climatology, and demography that owing to the facts (1) that tuberculosis causes more deaths than any other disease; (2) that it is now known to be communicable, especially to persons living in houses and shops with consumptives, that the attention of national, State, and municipal authorities be directed to the necessity for controlling the dissemination of the disease by (1) notification by physicians and householders; (2) regulation of the residences of the tuberculized; (3) controlling, as far as necessary, their movements; (4) establishing of hospitals and homes for the infected poor.

Discussion on the resolution, which was finally adopted, was carried on by the following:

Dr. J. G Hopkins, of Thomasville, Ga., said: Now that my object has been accomplished, I rise to explain my purpose in opposing the adoption of the resolution. It was to induce discussion upon a resolution on a subject of vital importance, which seemed clear to my mind was about to pass with a word. Now that that object has been accomplished, I arise to say that I am in favor of it except so far as it applies to hospitals. I am in full sympathy with the gentleman who proposed the resolution. I have been upon that platform a long time, and I believe those who are not are persons who have not investigated the subject with sufficient thoroughness. I oppose hospitals for consumptives or crowding them in any manner. The proper manner to dispose of them would be to isolate them in the cottage system. What I might say further would be but repetition and do violence to the intelligence of this congress, as most that has been said in this discussion so far is embodied in an article I read before the Georgia Medical Association last May, and published in the Journal of the American Medical Association in July, and of course has been read by you all.

Dr. Peter D. Keyser, of Philadelphia, Pa., said: I rise to sustain the resolution as presented in relation to tuberculosis, and say that it is necessary to educate the mass of the people by compulsion in the matter of prevention of contagious diseases. The great body of the people do not really think in these matters, but are governed by ignorance as well as sympathy. Many do not read any circulars that may be sent by the health officer to the houses; others can not read, and therefore take no notice of the same; and therefore for their benefit, as well as for the benefit of the people, is it necessary to educate in this matter compulsorily. I therefore hope that the resolution will be adopted. Many people will do nothing except under law, and therefore if a law to regulate this question of tuberculosis be adopted it will be respected and this disease no doubt abated.

Dr. William E. Driscoll, of Muncie, Ind., said: I differ from the gentleman from Oregon. It is far from my purpose to impute to any gentleman or lady in this presence that they are tainted with syphilis, and I do feel sure that everyone present is in danger of contracting consumption. There has not been a day since we began to live that all of us have not breathed into our lungs the seeds of this dreadful disease; and the only reason we are not suffering from consumption to-day is because we have not furnished a suitable soil for the lodgment and growth of these germs. We are in danger at all times, especially when brought repeatedly in close proximity to this infection. Of course syphilis, scrofula, and kindred diseases render the subject more easily infected and less powerful to resist this disease. It is folly to claim that syphilis is intimately connected with this disease any more than fever, pneumonia, or any other malady. I am in favor of educating the people and legislating on this subject. It is time we were taking national and State legislative steps in the direction of removing the danger to the uninfected.

Dr. Lawrence F. Flick, of Philadelphia, Pa., said: I wish to set the discussion right in a few things that it has gone wrong in. The resolutions do not contemplate enacting law. The boards of health have power to place a disease on the list of returnable diseases. The recommendation of the establishment of hospitals is simply recommending a measure to our Government for consideration. Two statements I wish to protest against. First, that there is any relation between syphilis and tuberculosis. No one acquainted with the facts would make such a statement at present. Secondly, that we inhale tubercle bacilli all the time and everywhere. This erroneous idea has done more harm and has done more to prevent the progress of preventive medicine than aught that has ever been said and done. I would say in connection with this matter that very few of us have probably inhaled tubercle bacilli. It requires special environment to convey tuberculosis. It requires exposures by social relations, and continued exposure, to contract the disease. No man, no matter what history of heredity he may have, what his physical condition may be, or how moral he may be, will withstand exposure to tuberculosis if the exposure is great and long enough.

Dr. William Tillman, of La Crosse, Wis., said: The resolution is good and if enforced will be a blessing to the country. I am afraid, however, that the public will fight against it for two reasons. In the first place, the public will not understand why such rigorous laws should be enacted, because they do not know that tuberculosis is contagious. Secondly, the public, and even our Government, will probably not be in favor of these laws, as the expense of disinfection, if carried out successfully, will be very great. In many instances it will be necessary not to disinfect but to destroy property (even houses). The public will surely fight this, and the Government will have to bear all the expenses. If these objections to this resolution could be overcome, I believe that the enforcement of these laws would be followed by the best of results.

Dr. Charles A. Lindsley, of New Haven, Conn., secretary of the State board of health of Connecticut, said that he thought the present discussion was one of the most profitable that he had listened to; that we would all go back to our homes with acquired information derived from this very instructive exchange of opinions. But there appears to be a remarkable persistence in misunderstanding the purport of the resolution under discussion. Gentlemen insist upon debating the expediency of legislating upon the means of controlling the spread of this disease. The resolution, as I remember it, does not call for legislation, but simply directs attention of State and local boards of health to the practical means of restricting the disease, to be used in the best manner that their discretion and powers may indicate. Dr. Bell has very emphatically insisted upon the registration of all deaths from tuberculosis. That is a very essential thing to do. But mere registration of such events, it is quite evident, is not sufficient, because in Massachusetts, Connecticut, Rhode Island, and many other States such registration has been practiced for many years without perceptible abatement of the disease. Something more than that is necessary.

Dr. Bell said the cases must be followed up.

Dr. Lindsley said: Yes, sir; that is the point exactly, and, to my mind, is just exactly what this resolution aims at—to have the State and local health authorities follow up such cases, guided by the present light of science upon the subject. I fully agree in all that has been said about educating the public, and I regard the operation of this resolution an important factor in such educational process.

Dr. William P. Lawler, of Lowell, Mass., said: Before putting the question to the house I wish to add my approbation to the resolution in its original form without any alteration or any further amending. It seems to me that some of the members are laying too much stress on the subject of law, which in reality does not exist in the resolution. By the passage of the resolution we do not bind

ourselves down by any legal obligations. The importance of this subject can not be overestimated. When we consider the terrible death rate that prevails in our midst year after year from the tubercle bacillus, we can not, in duty bound, sit here in silence and allow this resolution to pass unnoticed From my earliest boyhood I can readily call to mind whole families that have been swept away by this deadly enemy. On looking back to my college days I see some of the strongest and most perfect specimens of physical manhood fall victims to this unseen foe in the very prime and vigor of life. And in our own daily experience, gentlemen, in the practice of our profession, do we not witness the fairest and most beautiful of the human family sink into early graves from the very same cause, when youth, wealth, and medical skill prove to be of no avail? These are cold, hard facts, gentlemen, that can not be overlooked. But thanks to the recent discoveries and developments that have been made in regard to the pathology of tuberculosis, we have within our power, in the way of prophylaxis, more effectual means with which to combat this mortal disease, and, fortunately, we can see much brighter days in store for the whole human race. Gentlemen, there is no other disease about which the people at large are so densely ignorant, and at the same time so sadly negligent, as tuberculosis. Even many physicians, I am sorry to say, do not give it the attention that their duty requires. But the time has come, gentlemen, when the medical profession of the present day has got upon its hands a duty to perform that can be accomplished only by constant zeal and harmony of action. The substance of this resolution is only the beginning of a series of more stupendous and radical enactments that must necessarily follow from it; but it will establish a criterion on which we can act, and at the same time serve as a guide to medical and scientific associations that can develop it more fully in the not far distant future.

Dr. Peter H. Bryce, of Toronto, Canada, said that the statistics which he quoted seemed to him to be sufficient reason for urging the passage of such a resolution by the section. These figures showed its constant distribution in families, and hence attending physicians who have diagnosed the disease would report cases in order that the health authorities may aid them in further regulations of the sick. In the case of careless physicians, it is more desirable that the local boards of health have knowledge of cases in order that they may enforce sanitary regulations, and the facts referred to in the president's address on the danger to travellers from tuberculized travellers in the common apartments of railways and steamboats, indicate the absolute necessity for national and State attention to the making of special provision for the carriage of tuberculized persons to sanitariums, etc., while the presence of the tuberculized in work rooms, etc., demands that the regulation of this class be enforced, and in order that no hardship occur, it is desirable that the hospitals and homes to which they can go be established.

Dr. G. F. Patton, vice-president of the Louisiana State board of health and chairman of quarantine committee, moved the following resolution, which was seconded by Dr. Hopkins, of Georgia:

Whereas it is known that many of those stricken with yellow fever on merchant vessels at sea die from want of proper care and treatment at the hands of the masters of such vessels,

Be it resolved, That this section, impressed with the wide scope and humanitarian objects of the work undertaken by the Pan-American Medical Congress, hereby recommends that this congress shall ask of the various governments therein represented, and of all enlightened nations, that it be made part of the duty of consuls at ports infected with yellow fever to furnish every shipmaster clearing from such ports with a printed memorandum of instructions, to be issued by competent medical authority under Government supervision, and setting forth in simple language the principal points as to diagnosis, nursing, and treatment; these instructions to make it incumbent upon every such shipmaster to provide his vessel with a clinical thermometer, and with such articles of diet, stimulants, and medicines as may be therein specified.

The paper of Dr. John C. Wise, surgeon, U. S. Navy, entitled "A Brief Consideration of Elephantiasis Arabum as Observed in the Samoan Islands," was read by title. Also the paper by Medical Inspector George W. Woods, U. S. Navy, "On Some Peculiar Diseases Encountered in Naval Cruising, and Recent Observations on Hawaiian Leprosy."

The section then adjourned.

THE SIXTH SESSION.

FRIDAY, *September 8, 1893.*

The section met at 9 A. M., the president in the chair.

A paper entitled "On Pestilential Conditions," was read by Dr. A. Nelson Bell, of Brooklyn, N. Y., editor of The Sanitarian. This was followed by a paper entitled "Responsibility for Spreading Disease," by Dr. Wolfred Nelson, of New York City.

Dr. Edward O. Shakespeare, of Philadelphia, Pa., thereafter offered the following resolutions, which, after discussion by Dr. Carter, U. S. Marine-Hospital Service; Dr. Austin, U. S. Marine-Hospital Service; Dr. Thomas S. Scales, Mobile, Ala.; Dr. Charles O. Probst, Columbus, Ohio; Dr. Henry B. Baker, Lansing, Mich.; Dr. G. Farrar Patton, New Orleans, La.; Dr. Elijah S. Kelley, Minneapolis, Minn., were unanimously adopted and directed to be referred to the congress in general session:

Resolved, That the following resolutions be added to the resolutions already adopted and reported to the general session, relative to temporary suspension of immigration, to wit:

Resolved, That in the opinion of this section the thorough disinfection, without discrimination, of every piece of baggage, dunnage, or article of personal effects belonging to the immigrant classes and to crews of immigrant ships, and the exaction of scrupulous cleanliness of all vessels arriving at Pan-American ports should be rigidly enforced at American ports, supplementing and enhancing the protective value of similar treatment at the ports of departure, especially at times when cholera exists in Europe, as a sanitary precaution, second only in efficiency and importance to the temporary suspension of immigration.

Resolved, That it is also the opinion of this section that the habitual and thorough disinfection of all personal effects liable to carry contagion of immigrants to the American Hemisphere, and of dunnage of crews of vessels carrying immigrants from any quarter of the globe, and the exaction of scrupulous cleanliness of all vessels arriving at American ports should be enforced at all times as the most efficient means of greatly lessening the introduction into this hemisphere of the seeds of various contagious diseases, which are now and have been in the past almost constantly conveyed by the immigrant classes and distributed widely among the population of this hemisphere.

Among other remarks, Dr. Bell said, with reference to Dr. Nelson's characterization of an ideal quarantine, that, in his judgment, an ideal quarantine is that which implies the maintenance of such scrupulous cleanliness at the port of arrival as to require no quarantine except the exaction of equally scrupulous cleanliness of all vessels, merchandise, persons, and personal baggage purposing to enter such port.

A paper was thereafter read "On Demographic Statistics of Disease in the State of Michigan for Fifteen Years Consecutively," by Dr. Henry B. Baker, secretary of the State board of health of Michigan.

Dr. Charles A. Ruggles, president of the State board of health of California, opened a discussion on the subject of the prevention of the spread of diphtheria, which was participated in by Dr. A. Nelson Bell, of New York; Dr. A. B. Baker, of Michigan; Dr. John S. Arwine, of Indiana; Dr. Lewis, of North Carolina; and Dr. Samuel Garlick, of Connecticut.

Dr. Arwine, of Columbus, Ind., said: I regard the paper on diphtheria an able résumé of the consensus of medical opinion. As I understand it, the majority of

the profession entertain the opinion that Loeffler's bacillus is the specific cause of the disease. If my memory serves me correctly, some observers claim the presence of the bacillus necessary to establish the identity of diphtheria. This may be the true theory, but I am not prepared to accept it as such. I am of the opinion diphtheria is the result of a specific poison more subtle and dangerous to human life than the bacillus, though not recognized. It operates upon those who come in contact with it insidiously, causing them to become weak and anemic with irritable fauces, whose mucous membranes are denuded of much epithelium by the action of this subtle poison, which has prepared the fauces to throw out the diphtheritic deposit, probably nature's effort to repair the mucous membrane; but as the system is poisoned or depraved, nature fails, and the exudate forms a nidus for the bacillus, which is secondary and in no way causative. The inhabitants of that beautiful little city, Columbus, Ind., which I have the honor to represent, quite recently experienced an endemic of diphtheria, which hovered over the city from June, 1892, to January, 1893. The outbreak occurred in a tenement located on a low lot, where the ground water stood from 3 to 5 feet below the surface. Storm water frequently forms a pond on the back lot. Consequently the hygienic condition of the place is bad, and as there was no suspicious case to refer to as the possible cause of the outbreak, it is quite probable the poison causing it was generated on the lot, or in the tenement, where it became a focus that spread among the people, increasing in virulence until in September there were reported 60 cases; October, 40; November, 50; December, 10—a total of 160 cases, of which 30 died. It is probable that nine-tenths of those who suffered with the disease were occupants of tenements where the hygienic surroundings were anything but good. (Landlords with us are not noted for making hygienic improvements for their tenantry.) While this is true, I must not omit mentioning the fact that quarantining was neither enforced nor observed as it should have been; consequently the disease lingered with us. To sustain the idea of diphtheria being due to a subtle poison, I will mention the fact that some six or eight weeks since an outbreak occurred some 25 miles southwest of Columbus, Ind., in a sparsely settled, broken district, some 15 or 20 miles from railways, through which no well-used thoroughfare passes. In this neighborhood most of the dwellings are found along the narrow valleys of the small streams on the foothills. The inhabitants obtain water for family use from shallow wells, which yield surface water and shale scrapings; the hills being underlaid with blue shale, which is covered with sandstone and clay. The streams in this part of the country are, in the latter part of summer, usually found to contain no water save an occasional pool, about which stock gather, causing them to become quite filthy, and in case of extreme drought, such as is now upon us, one can better imagine the character of the water drawn from the shallow wells than describe it. Certainly it can be nothing but the scraping from cesspools and shale beds surcharged with mineral, vegetable, and animal poisons of sufficient virulence to destroy the nutrition of those who habitually use it. I imagine the continued use of water thus drugged will not only destroy nutrition, but irritate the fauces, destroy much of the epithelium of the mucous membrane, which causes them to throw out a deposit that frequently becomes diphtheritic, with all its attendant consequences. As the aforementioned outbreak could be referred to no suspicious case, there is every reason to believe it sprang from the poisoned water. I know of no reason that can be adduced why a disease thus started may not assume the form of a contagion or infection and spread as such among those who are exposed to the action of the same or a similar poison.

Dr. William P. Lawler, city physician of Lowell, Mass., said: The report of Dr. Baker on the summary statement of the Michigan State board of health, containing as it does such thorough yet simple diagrams and tables, are so complete in all its details that I consider it the duty of this section to confer upon the honorable

gentleman of the Northwest a unanimous vote of thanks and an expression of our sincere congratulations. The matter and form of this report are so replete with practical information, all tabulated before the eye in the simplest manner possible, that I regard it as a document of much value. Without going into any discussion as to whether diphtheria, primarily, is a local or a constitutional disease, it can not be denied, from the numerous recent experiments and microscopic examinations of pathologists, that there are many cases in which the origin of this disease is purely local. We know that diphtheria is extremely contagious; we know that it is preëminently a disease of childhood, and, ever bearing these facts in mind, we can not attach too much importance to its prophylaxis. Prevention is always easier than cure. This rule holds good in all diseases, and in diphtheria it is but too clearly demonstrated. The physician in these cases can not act alone. He requires the coöperation of the local and State authorities. And, here, gentlemen, comes in the duty of local boards of health. In the city of Lowell, Mass., which, by the way, I have the honor of representing at this congress, the board of health has done much during the past few years in curtailing the spreading of diphtheria and other contagious diseases. In our city every physician is required by law to report to the board of health each and every case of contagious disease as soon as discovered. An officer of the health department is immediately sent to the infected premises, and the house is placarded. A printed pamphlet is given to the inmates of the house describing the danger of the contagion and the grave necessity of isolation and disinfection. The disinfection is always conducted by a health officer. Notice of the disease is also immediately sent to the school board so that no children living in the infected house will be permitted to go to school until the danger of contagion has passed. The importance of thorough cleanliness, good ventilation, and plenty of sunlight is ever kept before the minds of the people in all cases where contagious disease exists. Gentlemen, when every man, woman, and child can be convinced of the importance of isolation and disinfection in all contagious diseases; when each and every man can be brought to realize the fact that it is his conscientious duty toward his neighbor, his city, and his country to do all in his power to prevent the propagation of these deadly diseases, and that he will exercise this duty by prohibiting any of his family, whenever there is a case of contagious disease in his household, to enter a school, church, public library, theater, ballroom, railroad station, or any public conveyance—then, gentlemen, when that time comes, when every citizen becomes a sanitarian, we can look for a remarkable abatement of diphtheria and all other contagious diseases, far greater, indeed, than the combined action of all the drugs and medicines contained in the pharmacopœia.

A discussion on the subject of the identification of immigrants and their baggage after examination and disinfection in transport to other localities was opened by Dr. Henry B. Baker, of Michigan, and participated in by Dr. Montizambert, of Quebec; Dr. Austin, of the U. S. Marine-Hospital Service, and Dr. Elijah S. Kelley, the commissioner of health of Minneapolis, Minn., the latter gentleman warmly commending and indorsing the system in practice at the Grosse Isle Station on the St. Lawrence River, near Quebec, under the superintendence of Dr. Montizambert.

Dr. Kelley said: During the cholera scare of 1892 I had the honor of being a representative of the great State of Minnesota, sent to investigate the processes of fumigation and disinfection in active operation at the various quarantine stations upon our Atlantic coast. At Sault Ste. Marie we investigated the quarantine system adopted by the State board of Michigan and the apparatus for disinfection of immigrants, baggage, and clothing. This consisted of a box car, side-tracked, connected with a stationary engine by 100 feet of rubber garden hose, running under the iron rails or tracks. The clothing of the immigrants

was hung on wire ropes inside this car and the steam admitted through an opening in the bottom of the car. The steam, passing through the hose, became cooled to such an extent that the clothing in the car was simply saturated with moisture and was far below any temperature calculated to destroy bacilli of any kind. In my opinion, it was better adapted for the prolific generation of bacilli, and markedly inferior to sunlight and air as a germicide. What prompted such a travesty upon the intelligence of our citizens can perhaps be explained by Dr. Baker, of Michigan. Twenty-seven immigrants detained for twenty days without water-closet accommodations, the fæcal deposits accumulating beneath the car in which they were kept; no means afforded for cooking food or for bathing. In many instances the immigrants wandered all over the city without restraint. This was a condition of affairs as inhuman and barbarous as the culpable ignorance which prompted it. In Boston we were royally entertained. We were taken down the harbor to an island which nature had provided for quarantine purposes. Hospitals for contagious diseases were ample, but the apparatus for the disinfection of immigrants was a farce. A box made of rough boards, 7 feet wide, 8 feet high, and 10 feet long, with a door and hole in the side for the introduction of a rubber hose to convey the steam from the steamer, was the whole quarantine outfit for fumigation and disinfecting in sight. That very morning immigrants from questionable points in Europe had passed through Boston Quarantine, destined for the Northwest, and in Boston Harbor were two vessels, one loaded with beet sugar in sacks, direct from Hamburg for Boston sugar refineries, the other loaded with baled rags, direct from cholera-infected regions of Europe. Let silence on my part express the feeling of indignation which words can not, as to the inefficiency of such a quarantine and its protection to the people of Minnesota. Our visit to Grosse Isle, Quebec, Canada, was a surprise. There we found a quarantine in reality and a health officer discharging his duties manfully to his own country and the whole Northwest. A boat specially fitted with sulphur appararatus and corrosive-sublimate solution for the disinfection of the vessels, a sterilizer of larger size was in operation, where clothing could be readily placed in this iron cylinder and air exhausted, then steam heated to 230° admitted, insuring certain destruction to any form of bacillus. Detention hospitals, cooking establishments, bathing rooms, water-closets, for male and female, wash rooms, police patrol, and ambulances for the removal of the sick. Telegrams warned the officer in charge hours before infected vessels reached the quarantine line. The ashes of cholera-infected baled rags whitened the rocks and the smoke darkened the air above them, while military exactness, honesty of purpose, and intelligent work everywhere indicated that a master mind familiar with every detail and phase of quarantine service, directs and controls, and deserves the gratitude of the whole Northwest.

The following papers were read by title: "Movimiento Demográfico de Buenos Aires," by Dr. Samuel Gache, of Buenos Ayres, República Argentina; "On the Methods Employed for the Prevention of Disease and Preservation of the Lives of the Inhabitants of the District of Columbia," by Dr. Charles M. Hammett, of the city of Washington, health officer of the District of Columbia; "La Embriaguez: Sus Causas, sus Efectos, Urgente Necesidad de Disminuirlos. ¿Caules Serían los Medios más Adecuados Para Obtenerlo?" by Dr. Salvador Garciadiego, of Guadalajara, Mexico; "The Study of Type in Relation to Suicide," by Dr. Roland G. rtin, of Philadelphia, Pa., ex-president of the American Climatological Association.

After a few closing remarks in English and Spanish by the president, to whom a vote of thanks was then tendered, the section adjourned at 11 A. M. to meet in general session with the Congress.

PAPERS READ BEFORE THE SECTION.

ON THE PROPER STATUS OF THE MEDICAL PROFESSION IN THE GOVERNMENT OF NATIONS.

By CORNELIUS G. COMEGYS, M. D., of Cincinnati, Ohio,
President of the Academy of Medicine.

Mr. PRESIDENT: In the presence of this august assembly of representative men of both continents of the Western Hemisphere, it seems to me an auspicious moment for the consideration of the relations which should exist between our profession and the executive departments of governments. Some are startled at the proposition that a physician should be made a minister of state, holding a position and exercising functions in regard to public affairs on a parity with the heads of other departments in the cabinet of a nation. In the history of governments the medical profession has not only been tolerated, but in those that stand on the highest plane of civilization it has been fostered by subventions of the state, and in order that the people could receive the full benefit of our beneficent art, liberal provision was made for the construction of edifices, libraries, laboratories, and museums for scientific culture, and free access given to hospitals for the observation and treatment of diseases and injuries. In this magnificent capital of the United States, the Government through the operations of the Surgeons-General of the Army, Navy, and Marine Hospital, has made liberal expenditures for the establishment of a national medical library and museum, the publication of an index catalogue and the army medical records of the civil war, and for researches at home and abroad on the origin and nature of epidemic diseases likely to be brought to our shores by immigrant and other ships, but beyond these sanitary provisions our central Government does not go. There is no office here for the collection of facts in demography and hygiene; no means provided for the exploitation of measures that could direct continuous scientific research in regard to endemic and epidemic diseases in every part of the nation. Nevertheless, through the influence of the American Medical Association, State boards of health have been organized in most of the States, but no central office exists in Washington, in which data can be brought into a uniform expression that will present the conditions in demography and hygiene that have been attained in English and Continental States in Europe. On this account an active movement is now in progress by the American Medical Association to obtain an act of Congress to establish a department and a secretary of public health.

In primitive history we find that Hygeia and Therapy formed so conservative a feature in the afflictions of people that wise men, instead of seeking laboriously in the known arts and sciences for an explanation of the success of medical treatment, attributed it to the beneficence of the heavens, and so precious were the discoveries of preventive and practical medicine that the documentary testimony was carefully preserved in the temples of religion; indeed in theocratic governments they became a part of the instruction of the priesthood. We can not read without admiration of the wisdom and forethought which made sanitary measures a part of the religious code of the people. The hygienic laws of Moses, which undoubtedly embodied fragments of his Egyptian training both as a priest and physician, and the moral code, the Ten Commandments, received from the hands of God, have been kept together by the Jews in the structure of their holy books, and sacredly practiced for thousands of years, which clearly accounts for their

existence physically and mentally as one of the strongest races among the multitudes of the earth. A glance at the past shows that the course and development of hygiene on one hand and the progress of the sciences and growth of the mind on the other, have constituted great factors in the evolution of humanity; nevertheless, in modern times medicine has not held the rank and dignity in the executive department of governments that have been allotted to jurisprudence, diplomacy, arms, and finance, notwithstanding the maxim which has descended from the remotest ages, "The health of the people is the supreme law." An enlightened and liberal investigation of the medical office shows that it appertains to a most important function in a commonwealth. There are no evils in society that physicians have not a large ability to restrain; there are no foes of human happiness so widespread, miserable, and despairing as those which undermine public health. An English physician of great distinction said a score of years ago, in a public address, "I think it will be well for the State when the profession to which we belong is represented in the councils of the nation as weightily as can be assured by official places and conferred dignities." It is impossible to exaggerate the value to a State of the medical profession; it envelopes and penetrates not only the individual but the social and political fabric as well. It is productive and conservative in its ministrations. We are pledged to alleviate suffering and contend against death. We also are teachers of the laws of health and walk as sentinels about the encampment of the multitude. In war we go with armies to care for the fevered soldier and follow him through the thickest of the fire not to aid destruction in her work but to staunch the wounds she makes. It is not the bugle call nor the roar of battle that arouses our activity, but the cries of the wounded and dying, the appalling ruin of the field. In our civil practice, on every hand is infirmity, despair, death; hoping to strengthen or to avert, our days are occupied; in the effort to sustain the hopes, the agonies, the distress of society our burdens are often too heavy to be borne. These are not overdrawn statements; there are many in this audience who can verify them. It is certainly a remarkable spectacle, the constant effort of physicians to save the people from disease when success will limit to the smallest dimensions the practice of medicine. But this grows out of the nature of their studies, the tendency of which gives the highest motive for unselfish service to humanity. The physician is bound to render service to the poor and rich alike. The amount of gratuitous service, especially in great cities, constitutes one-third of their practice. The most distinguished and experienced of the profession form the staffs of all of our hospitals and without salary. If there were cruelty to prisoners on either side in our civil war, it was not perpetrated by the surgeons of the opposing armies; and when the strife ceased they were the first to extend the fraternal hand across the field of conflict. Prompted by the most noble instincts, physicians in their efforts to enlighten the lowest races have distinguished themselves in geographical discovery. Dr. Mungo Park whilst traveling among the barbarous Africans discovered the great Niger; Dr. David Livingston in our times, actuated by the same motives, found the Congo and the vast lakes which are the sources of the Nile; Drs. Kane and Hayes, of Philadelphia, in their search for the lost voyager, Franklin, penetrated into the Arctic Ocean farther than any former travelers. A multitude of physicians have gone with religious missionaries in their efforts to shed the light of our civilization on barbarous and semicivilized peoples in every part of the globe. Success in missionary efforts is only made possible by the culture and works of beneficence displayed by medical men and women. Until physicians entered China there existed no scientific knowledge of anatomy and physiology. Surgical science was not known sufficiently to lead the doctors there to tie a bleeding artery, and there was no relief for women in the cruel adversities of parturition, nor was there any knowledge or practice of

hygiene, nor any measures for staying infectious diseases. In 1834 Dr. Peter Parker, under the patronage of the Presbyterian Church in this country, established the first hospital in the city of Canton. Since then five other ports have been opened to missionary work, and there now exist 60 hospitals and dispensaries, and several hundred physicians are constantly practicing among the people. In Parker's hospital there have been performed 1,600 operations for stone and with marvelous success; and during the year 1892 there were saved over 100 women in childbed, who would have perished in the hands of native practitioners. In India the British Government has established 1,600 hospitals and dispensaries, and besides these Christian missionaries have created a large number. Medical schools have also been opened under the English patronage, and thousands of natives have been instructed systematically in medicine, and incalculable relief has been furnished to the people in sickness. The superiority of the equipment and training of the English army led to the conquest of India, but the great skill and success in the practice of medecine has won the confidence of the people and helped them to become reconciled to their conquerors. Civilization can not be established permanently without the science and practice of medicine. A great race of men is slowly perishing within the Government of the United States, which might long since have been made productive, intelligent, and peaceable citizens if certain numbers of their youth had been separated from the wild, warlike life of the wigwam and trained in the common, technological, and professional schools of civilization. Instead of this they have been preyed upon and demoralized by the agents and the post traders of their reservations. It is reasonable to believe that medical capacity and its humane influences would have been a powerful factor in their regeneration if it had had more influence in the executive department of the Government. It is not too late to save the remnant from the impending destruction. The medical profession holds itself ready, as it always has, not only to diminish the destruction by disease, but ultimately to destroy the contagions that cause it. It is well understood that infectious diseases and toxic elements are disseminated as food; that diseases in the family of a dairyman, or among his cattle, may be as widely diffused as his distribution of milk. The pollution of rivers, streams, and wells in towns, villages, and farmers' homes subject families to tedious and fatal diseases which a wise sanitation could avert. It is so absolutely demonstrated that by a rigid application of hygienic laws the ravages of a pestilence may be arrested, that medical scientists speak of such destruction as a self-imposed cause of dying in the prime of life. The progress of medicine in saving life in times of great distress is shown in the practice of midwifery and surgery. In a maternity hospital in Philadelphia not a single death has occurred in 1,500 successive cases, and in the maternity hospital in Paris over 2,000 successive deliveries have occurred without a fatal case. The deaths in capital surgery have become so rare that surgeons undertake with great confidence the most formidable operations and expect recovery without a drop of pus. Inflammations and fevers are now known to depend upon the presence of pathogenic germs; in the former the pernicious action is prevented by asepsis; in the latter by a treatment that will eliminate the toxic elements in the blood as rapidly as they are formed. On the other hand, one-half of the children in our crowded cities die under 5 years of age. This fearful mortality can be reduced one-half under the operation of sanitary laws directed by physicians. In the census reports of the United States for 1890, more than 500,000 deaths are enumerated in the different States. It is the medical belief that preventive medicine would have saved one-third of the lives.

Another subject, and one of the highest importance to the working classes, who are, so to speak, wards of the medical profession, has recently been developed by Sir James Crichton Browne, M. D., of England, which shows how much responsibility rests upon us to carefully investigate the wear and tear of the neuro-

muscular system by overwork. He proves incontestably that, owing to the strain in what is called "piece work," a workman who at 30 years of age can make 45 shillings a week and should be able to continue it for thirty years, finds that, strive as he may, he can not at 45 earn over 38 shillings, and at 55 he can earn no more than 28 shillings. A knife maker, who, by striking 28,000 blows a day with his hammer, can earn a good living, can not continue to earn half that much at fifty years of age. In all of these cases the failure is shown to be in the neuro-muscular systems of the arm and shoulder. Is not this a high example of cruelty to animals? Must not the medical profession enter its protest? Does not this concern statesmanship? But Sir James has carried his statistical investigations into the study of the limitations of life in the upper classes. For example, he says that while there is a marked decline of 17.6 per thousand in the death rate in all ages under 35, owing to the improved sanitation in the whole country, there is only a decline of 2.7 per thousand above 55 years; while between 65 and 75 the death rate is increasing. He adds that it is not very satisfactory to learn that while in babies and young people there is an enormous increase in longevity, the increased loss is alarming among those eminent in experience and judgment. He next shows that this decay in the mature element of society is found in a few groups of degenerative affections, thus: In cancer, in a period of thirty years, the increase is 134 per cent; in nervous diseases, 32 per cent; in kidney diseases, 164 per cent; in heart diseases, 143 per cent. He believes that this increased mortality is due to the increasing luxuriousness in our advancing civilization. He also refers to the alarming increase of insanity. In the United States we have no registrar-general, so it is impossible to make such demographic investigations. Are not the above researches a function of statesmanship? The importance of higher medical education is conceded now by all true physicians, and our best schools have undertaken to accomplish it. The great hindrance to its achievement lies in the lack of a central office in Washington of sufficient rank to exert an influence for a concerted action to that end, among the one hundred schools in the States. The American Medical Association has by its efforts secured annual meetings of the college authorities to consider the subject, and much progress has been made. Entrance examinations are now the rule, and the period of study is being lengthened to four years in several schools. All true physicians desire that all graduates shall command the respect and confidence of the people as thoroughly trained scientific men; in fact, ranking among the best educated men, in all respects, in a community.

There is another value that will be an outcome of higher practical education. It will be possible for physicians to undertake the instruction of the agricultural classes in the elements, at least, of chemical, physical, and biological science, by organizing in country towns courses of instruction in the winter season, wherein, by means of lectures and experiments, illustration and simple text-books, primers in science, they will be able to impart extensive instruction to this great but sadly neglected portion of our population and by which their practical power as producers will become greatly augmented and their social happiness increased. The freshest and strongest minds are found among farmers. This is an elevated and legitimate work for doctors. The organism called "medicine," like every other product of man's constructive genius, is striving to attain perfection, and to accomplish this it must be sustained in all its scientific undertakings by the coöperation of national and State legislation and by the people. Medicine has never been cultivated in the highest degree where it has had imperfect recognition as an element of the State. In the British and continental governments in Europe it has always had the watchful care of the state, and eminent practitioners are frequently receiving titles of distinction both from universities and chiefs of states. The degrees of LL. D. and D. C. L. are given to eminent medical men not only

here but by monarchs of Europe. These titles indicate their competency in statesmanship. Our methods of research are the same as those employed by lawyers, engineers, machinists, and by learned men in the whole range of the natural sciences; and the opinions of well-trained physicians are as certain as those given by judges, statesmen, architects, engineers, divines, bankers, and merchants.

Let me speak briefly on the increased light which physiology and pathology have shed on the relations of the brain and the mind. For a long time the brain has been known as the center of sensation and motion, but only within a few years have they been located in the special areas of that organ; but now we know the very seat, not only of sensation and motion and of their coördination for the execution of instinctive and purposive movements, but we can put our fingers on the exact region where sensations are shaped into concepts, where ideas are symbolized in language, where memory has its seat, and the imagination displays its marvelous powers. All the apparatus of respiration, of digestion, of circulation, of the vast neuro-muscular system, is merely to sustain a certain definite area in the brain which we can cover with our two hands; it is the realm of consciousness—the plane where spirit and matter greet each other, so that a man can say, "I know that I know;" "I feel that I feel;" "I think that I think;" it is where the consciousness is in equipoise with the immensity of the cosmos. Gravitation is instantaneous; consciousness just as rapidly reaches from the center to the circumference of the universe. Who has the right to supervise this dread region but the physician? Closer than the minister of religion, or the ties of blood, he is the guardian of its illimitable faculties. Through physiological and pathological research, psychology has been lifted above the subtle reasoning of the schoolmen into the light of a new day, and it is now comprehended as never before. Metaphysics is no longer a jugglery with words, but is a function of consciousness existing only in the healthy brain. It is the purest and highest expression of reason and a free will, and can not be displayed but by the healthy brain. It is a psychological systemization of terms under the regulative faculty, the will, whereby the intuitional phenomena of thought and the phenomena derived through the senses from external objects—the ideal and the real, the subject and the object—are brought into accord, and the mind is freed from baleful illusions, hallucinations, and delusions. The imperfect state of consciousness in unsound sleep wherein ideas flow, regulated only by their automatic association, represents the abeyance of the metaphysical function. We are led everywhere by the most grotesque, absurd, and fearful ideation without self-control. There is no metaphysics in dreams, nor is there any responsibility for the actions or thoughts of a person in dreams, because his consciousness is not under the regulation of will. He may know right from wrong in dreams, but he is irresponsible.

Physicians, because of their knowledge of the brain and the mind, possess abilities for broad and useful services in the social and political state, and no man in the Cabinet would serve better as a counselor to a ruler than an expert physician.

I have shown that the regulative faculty of the mind—the will—is not a transcendental entity to be considered apart from physical existence, but, so to speak, is the correlative of the total organic power of the brain, and is therefore amenable to sound hygienic laws, without the operation of which this magnificent endowment of man can not be displayed. Let the fine physical organization of the brain suffer deterioration from any cause and the man no longer controls his ideas, but on the contrary he is led by them and too often driven. We warn men, but they do not heed us. They mock our solicitude and boast of their capacious powers, but sooner or later the wear and tear shows itself—the pilot is losing his keen eye and firm grasp of the helm. The stupendous ventures in stocks and produce in the great centers of commerce are frequently manifestations of intellectual perversion, superinduced by the constant excitement attending these operations,

Every faculty of the dealer's mind, intellectual and emotional, is urged without restraint beyond normal capacity; his reason is in abeyance; his actions are impulsive and dangerous to his environment. To grasp, to conquer, to accumulate, to control, to hate, to lust, any or all of the terrible elements of evil, may arise and govern the life of a man. His reason is subrogated to his passions, which like ferocious beasts are ready to leap upon and destroy his existence. The morbid drama now being enacted in our financial world is simply the outcome of the delirious speculation that has raged for years past. Luxury and vice have clung together and formed the deadly moral dynamite whose destructive force is seen in every direction. These catastrophies have been predicted by medical psychologists for years past. History furnishes fearful examples of the ruin of states and empires because of the licentiousness, tyranny, and an inappeasable thirst for conquest of men whose early characters exhibited self-denial, justice, and peace.

I have not the time for an elaboration of these important questions, which include the physical, moral, and intellectual culture of the rising generation of a State. It was a subject that deeply concerned the eminent statesman and physician of our revolutionary era, Dr. Benjamin Rush. I will briefly add that there are no fortuitous conditions that concur for the best political circumstances of the State; the whole is purposive intelligence existing in the individual and combined for the exigencies of society. Wherever the highest development of physical health exists there will be found the surest basis of the best mental faculties. These are not mere abstract themes of philosophy, but the most practical questions of the day, interesting not only to the people at large, but especially to those who control the destinies of nations.

The question may arise whether the proposed department of public health would subserve the interests of any particular school. I reply no: that amid all the apparent disparity in medical practice there is one true severe unity, and to attain this all true physicians are continually striving. With the advance in the way of higher education the differences in modes of treatment will gradually disappear. There is no disputation in medical science in regard to anatomy, physiology, pathology, chemistry, physics, or preventive medicine. The general modes of practice will become gradually unified.

I now insert an extract of the bill which was introduced in both Houses of the last Congress of the United States, and which still remains on the files of the committees to which it was referred, in order to show its intent.

A BILL to establish a department of public health.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there shall be established a department of public health. There shall be appointed from civil life by the President, by and with the advice and consent of the Senate, a secretary of public health, who shall be intrusted with the management of the department herein established. He shall be paid an annual salary of ———. He shall, with the approval of the President, provide suitable offices for the department, and shall employ such assistants and clerks as may be necessary.

SEC. 2. That it shall be the duty of the Department of State to obtain from consular officers at foreign ports and places all available information in regard to sanitary conditions of such ports and places, and transmit the same to the department of public health; and the secretary of public health shall also obtain, through all sources accessible, including State and municipal authorities throughout the United States, weekly reports of the sanitary condition of ports and places within the United States, and shall prepare, publish, and transmit to the medical officers of the Marine-Hospital Service, to collectors of customs, and to State and municipal health officers and authorities weekly abstracts of the consular sanitary reports and other pertinent information received by said department. The said department also shall, as far as it may be able, by means of the voluntary coöperation of State and municipal authorities, of various general and special hospitals and sanitariums, of public associations, and of private persons, procure and tabulate statistics

relating to marriages, births, deaths, the existence of epidemic, endemic, and other diseases, especially those of a degenerative character, such as malignant growths and affections of the circulatory, respiratory, secretory, and reproductive organs, and data concerning the fruit of incongruous marriage and transmissibility of insane, alcoholic, syphilitic, nervous, and malignant types of constitution. He shall also procure information relating to climatic and other conditions affecting public health, especially in reference to the most favorable regions in the United States for the cure or relief of the chronic diseases of the several organs of the body, especially of consumption. He shall also obtain information in a sanitary point of view of the health and comfort of the laboring classes. He shall seek through the State boards of health information in regard to the healthiness and comfort of public schoolhouses. He shall, so far as he can, further collective investigations in regard to the common diseases of an inflammatory and febrile character that prevail among the people. He shall coöperate with State boards of health, the Signal Service, the medical departments of the Army, Navy, and Marine-Hospital Service, and unify and utilize their work so as to make the department of public health a repository of the most important sanitary facts that concern the public comfort. Besides the reports of the state of public health, which he shall make from time to time, the secretary of public health shall make an annual report to Congress, with such recommendations as he may deem important to the public interests; and said report, if ordered printed by Congress, shall be done under the direction of the department.

The question I submit is this: Have we qualifications, through the operations of our profession, to contribute to the progress of Governments, increasing happiness, intelligence, and public virtue? If we affirm that we have, then shall we not claim the rank and dignity in the State that will give us the highest opportunity for their exercise?

OJEADA RETROSPECTIVA SOBRE LA ORGANIZACIÓN DE LA SANIDAD EN LOS EJÉRCITOS ESPAÑOLES. PRIMEROS ALBORES DE LA MEDICINA MILITAR EN AMÉRICA.[1]

Por el Doctor FELIX ESTRADA CATOGRA,

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No es posible separar la historia de la medicina militar de la de los ejércitos en campaña, por lo que hace á nuestra patria, pues doquiera acudieron las tropas españolas, fueron acompañadas de físicos y cirujanos que en medio de las batallas, en los rigores del combate, restañaron la sangre de los heridos, curaron las enfermedades de los combatientes, sufriendo las penalidades del soldado, participando de todas las calamidades de la guerra. Y no solo ha pasado así desde el invento de la pólvora, desde la aplicación de la artillería, sinó desde los primitivos tiempos de nuestra historia, como es fácil comprobar por la lectura de los códices más antiguos.

No es extraño que así sucediese, si se tiene en cuenta que la medicina vulneraria ha sido una de las primeras conquistas hechas á la naturaleza en las primeras edades del mundo, como dice un galano escritor que tuvimos por maestro.[2] "Allí donde por primera vez luchó el hombre de un modo material"—dice un historiador de nuestros días—"por defender su derecho, ó por dar amplitud á sus deseos y aspiraciones, y hasta satisfacción á sus vicios y malos pensamientos, allí empezó la medicina militar. Primero la lucha, después el modo de remediar sus estragos, esto es lógico; en todos los países ha tenido que suceder así y por consiguiente en España."[3]

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[1] Este trabajo constituye el primer capítulo de una memoria inédita sobre el orígen, organización y servicios de la sanidad militar en Cuba que pensamos publicar.

[2] Vicisitudes y progresos de la medicina como ciencia y arte en relación con los demás conocimientos. Discurso del catedrático de patología de Santiago, D. Ramón Otero.

[3] Historia de la Medicina Militar Española, por D. Antonio Población.

Recorramos la Iliada y la Odisea, que podemos considerar como primitivos anales de las ciencias médicas, y allí veremos al hijo de Apolo, al gran Esculapio, descendiendo á la tierra para enseñar á los mortales el arte de curar y evitar la fria segur de las inflexibles Parcas. También Homero canta en inmortales versos el valor de Podaliro y Chiron, y de otros príncipes que en los campos de batalla alcanzan gran renombre, no sólo por sus heróicos combates, sinó también por la habilidad que muestran al restañar la sangre de los heridos.

Probado está por las investigaciones de literatos y médicos, que los ejércitos griegos y romanos contaban con médicos y cirujanos que los acompañaban en las guerras. Simpson,[1] Kühn[2] y Aubertin[3] han demostrado la existencia de médicos militares en las legiones egipcias, griegas y romanas, y en todos los ejércitos de la antigüedad.

Nuestra patria, teatro de grandes acontecimientos militares desde los primeros conquistadores, centro de luchas y discordias intestinas al constituirse la monarquía goda, en combate con los árabes durante algunos cientos de años para reconquistar el territorio, fué sin duda una de las naciones en que más predominó el espíritu guerrero en que más necesarios se hicieron los servicios humanitarios para asistir á los combatientes heridos en las frecuentes luchas; así no es extraño que los servicios medico-castrenses tengan en nosostros un orígen más antiguo que en las demás naciones de Europa, y así también que durante muchos años España marchase á la cabeza en cuanto se refiere á la organización sanitaria de los ejércitos.

En casi toda la Edad Media, así en España como en otros países, la medicina era estudiada y practicada muy especialmente por los judíos, tan numerosos en las naciones cristianas y muy particularmente en la nuestra, cuanto que las leyes que contra ellos promulgaron varias veces los reyes godos posteriores á Recaredo, eran inspiradas por el miedo que hubo de que llegaren á formar de España un estado judaico, atribuyéndoseles también gran participación en la conquista árabe. El Fuero Juzgo contiene leyes expresamente aplicables y referentes á los médicos judíos, por cierto bien crueles y absurdas, pues entre estos hubo verdaderos sabios que hicieron progresar la medicina, como el famoso Yzdrag, médico del rey D. Alonso VII de Castilla y otros muchos que cita Hernández Morejón, como hábiles cirujanos que contribuyeron al adelanto de la medicina patria.

El establecimiento de hospitales en España es también de remotos tiempos, y aunque faltan datos anteriores al siglo doce, no sería difícil encontrar noticias aisladas aquí y allá, no tanto en las crónicas (que estas eran demasiado secas y concisas en los principios de la Edad Media) pero sí en los archivos monacales y otros de villas, ciudades é iglesias del reino, en que se habla de fundaciones de hospitales por nuestros reyes, en particular para leprosos, desde los primeros tiempos de la monarquía asturiana; pudiendo decir otro tanto de los demás estados en que se hallaba dividida la península.

Consta sí que en el siglo doce existían hospitales para curar los heridos de la guerra, siendo fundado uno en Toledo por D. Pedro Fernández de Fuentecalada, maestre de la órden de Santiago. En el castillo de Guadalherza lo estableció la órden de Calatrava, y otros varios citan los historiadores en distintos pueblos de la península, demostrándose que esta institución sanitaria para los ejércitos es más antigua entre nosotros que en otras naciones de Europa. Quizás la influencia que la dominación romana ejerció en España, fuese la causa de existir hospitales para la tropa en nuestro suelo desde muy antiguo, pues sabemos por Higinio el

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[1] Was the Roman army provided with any medical officers? By J. Y. Simpson, president of the Royal College of Physicians of Edinburgh, professor of midwifery in the University, etc., 1851.

[2] De medicine militaris apud veteres Graecos Romanesque conditione. D. Carolus Kühn, etc., 1824 á 1827. Dissertations.

[3] Del servicio médico en los ejércitos de la antigüedad, por Ch. Aubertin, profesor de letras de la Universidad de Dijon, publicado en la Revue des médecins des armées.

Agrimensor, que los romanos en sus campos de guerra establecían el valetudinarium ó enfermería para sus soldados.

Las órdenes militares tuvieron también gran influencia en la creación de los hospitales, así como instituciones derivadas de ellas para la asistencia de los enfermos y peregrinos, no dejando de tener una gran participación en estas fundaciones las expediciones de los caballeros castellanos, aragoneses y navarros al Egipto y Palestina formando parte de las cruzadas en la conquista de Jerusalem.

Pero no vamos á seguir en este órden de ideas y volvamos á la fundación de verdaderos establecimientos dedicados á la hospitalidad de nuestras tropas. Los primeros hospitales de campaña organizados en todos sus servicios fueron los establecidos en España por Isabel la Católica. Hernan Pérez del Pulgar, al escribir sobre la conquista de Granada, dice: "É para curar los feridos é los dolientes, la reina enviaba siempre á los reales seis tiendas grandes, é las camas é ropa necesaria, é homes que les sirviesen, é mandaba que no llevaren precio alguno, porque ella lo mandaba pagar; é estas tiendas con todo este aparejo se llamaba en los reales el hospital de la reina."[1]

Pedro Martir de Angleria, que formaba en el ejército español el año 1489, escribió desde el sitio de Baza al cardenal arzobispo de Milán sobre este hospital, elocuentes frases que demuestran deben su orígen los hospitales de campaña á la munificencia de la egregia Isabel, á quien tanta gloria debe España y la causa de la civilización.[2]

Pero si existían hospitales en nuestra patria y si la historia nos ilustra respecto á los que para la conquista de Granada estableció la reina católica que podemos considerar como verdaderas ambulancias de campaña, si la legislación médico-militar la encontramos en las leyes de partida del sabio D. Alonso, si es fácil demostrar que á los ejércitos acompañaban médicos y cirujanos, no es tan fácil comprobar la organización dada á estos para el cumplimiento de sus servicios. No podemos dejar de estar conformes con el historiador médico-militar Sr. Población que dice sobre este particular:

Pero es indisputable que los médicos, cirujanos, farmacéuticos, practicantes y enfermeros socorrieron con organización; que no podemos determinar los desastres propios de la guerra; que hubo dotación de efectos quirúrgicos y de medicamentos y que el personal fué recompensado más ó menos ámpliamente por el dinero particular de la reina Isabel.

Esta falta de datos que encontramos en el servicio de la sanidad militar del período de la historia patria hasta los reyes católicos, corresponde á la vez á la falta de una organización para el ejército, que hasta esta fecha no puede considerarse como un verdadero organismo para la defensa del territorio según aquellos monarcas establecieron después en sus pragmáticas. En 1505 vemos ya aparecer un cirujano en cada una de las compañías llamadas guardas de Castilla que sustituyeron á las hermandades de Castilla organizadas por D. Alfonso el Sabio.

Al terminarse el glorioso reinado de los reyes católicos, el ejército estaba necesitado de grandes reformas, que acometió el ilustre cardinal Ximenez de Cisneros, á quien se debe mirar como uno de los más sabios generales, pues su espíritu militar se hizo patente en más de una ocasion.[3] Dicho gobernante, al hacerse cargo de la Regencia en enero de 1516 trató, de formar un ejercito respetable, oyendo la opinión autorizada de los militares más ilustres y conocedores de la guerra, entre

[1] Hernández Morejón: Historia de la medicina, f. 1, pág. 256.

[2] Clemencín: Elogio de la Reina Católica, Da. Isabel 1ª de Castilla, pág. 176.

[3] Conocida es la anécdota histórica de haber enviado los grandes una diputación para preguntar al Cardinal Cisneros en virtud de que poderes gobernaba, y la contestación que dió á esta, llevándolos hacia el balcón de palacio y mostrándoles un cuerpo de tropas de artillería que estaban maniobrando con cañones, les dijo: "Esos son mis poderes," ante cuyo argumento digno de un gran general, los nobles comprendieron que bajo aquellos hábitos se ocultaba un alma enérgica, un corazón de guerrero. Podrá no ser cierta esta anécdota desmentida hoy por autoridades competentes, como la de la capa de D. Enrique el Doliente y otras que han corrido como válidas en nuestras historias, pero no decae por ello el mérito que, como organizador del ejército de España, tuvo Cisneros.

ellos el Coronel Rengifo que ya había presentado una memoria al Rey Fernando y cuyo trabajo aprobó Cisneros, dictando órdenes para su ejecución.

Dicho trabajo, que teniendo en cuenta su época es notable, comprende ordenanzas militares, sistema de alistamiento, vestuario, etc., se dictó á los pueblos y vecindades en 27 de mayo de 1516, formándose según las instrucciones[1] un cuerpo especial de 400 hombres llamados pardos, especie de guardia real, independiente de los lansquenetes venidos de Alemania con D. Felipe, reformándose las compañías y tercios así como los mandos,[2] no echando en olvido en esta organización los servicios tan necesarios de los médicos, cirujanos y farmacéuticos,[3] así que al formarse los primeros tercios que fueron los de Lombardía, Nápoles y Sicilia figuran en la plana mayor estos destinos en el año 1534.[4]

Pasa para el cuerpo de sanidad militar el reinado de Cárlos I sin modificaciones en el servicio que prestaba en las tropas, pero figurando médicos distinguidos en el ejército y en las campañas del ilustre emperador. Cuando Felipe II recogió la rica herencia de su padre, trató de corregir defectos que había en sus tropas, empezando por reformar el ejército de Italia y en las instrucciones que dictó en Toledo á 24 de diciembre de 1560,[5] figura en presupuesto un médico con 15 escudos y un cirujano con 12, afectando al servicio de la sanidad militar algunas de estas instrucciones, pues se disponía fueran dados de baja todos los inútiles,[6] sufriendo modificaciones el traje militar con arreglo á la higiene de aquellos tiempos.[7]

No estaba tampoco desatendido el servicio de hospitales militares de campaña, pues en el presupuesto, como diríamos hoy, formado en 6 de septiembre de 1591,[8] aparece la partida siguiente:

Para el gasto del hospital se descuenta á cada soldado un real cada mes, y á los

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[1] Estos documentos, tan notables por la idea que dan del espíritu de la época, existen en el archivo general de Finanzas. (Estado, Secretarías provinciales, legajo No. 217), y los copió íntegros el Conde de Clonard en su Historia Orgánica del Ejército.

[2] En tiempo de los reyes católicos la unidad fué en un principio la compañía, después la colunela ó coronelía distribuida en 20 compañías. Luego vinieron los tercios, compuestos cada uno de tres coronelías y cada una de estas con 12 compañías. Cada tercio lo mandaba un maestre de campo. (Clonard, f. 3, pag. 156.) Sin embargo, el nombre de tercios es tan antiguo en Castilla, que ya en mil setenta y tantos, en el reinado de D. Alonso VI, se dice que Dia Sauz y Fernán García mandaban en la conquista de Madrid los tercios de Segovia.

[3] La existencia de los farmacéuticos en los ejércitos data en España del tiempo de los árabes. En Francia también, bajo el reinado de Enrique II, tenían farmacéuticos militares los hospitales de Metz y Thionville; Sully, ministro de Enrique IV, nombró un farmacéutico militar para el hospital de Amiens, siendo Richelieu el que aumentó el número de farmacéuticos en los hospitales militares. (Ver Mallaina: Historia de la Farmacia.)

[4] La plana mayor de cada tercio comprendía: 1 maestro de campo con 40 escudos mensuales; 1 sargento mayor, 20; 1 furriel mayor, 20; 1 municionero, 10; 1 tambor general, 10; 1 capitan barrachel de compañía con 12; 1 teniente de idem, 6; 1 médico doctor, 12; 1 cirujano, 10; 1 boticario, 10; 1 capellan, 12; 8 alabarderos de la guardia de honor del maestre de campo á 4 escudos, 32; total, 194 escudos.

[5] Relación de lo que montará el sueldo de un mes de tres mil infantes españoles con diez capitanes y sus oficiales y ventajas. (Clonard, f. 3, pag. 428.)

[6] Véase un trabajo del Sr. Montejo Robledo sobre el servicio de declaración de inútiles publicado en la Gaceta de sanidad militar.

[7] Sabido es que el uso de verdaderos uniformes data del pasado siglo y después del advenimiento de la casa de Borbón. En Francia tampoco son más antiguos que Luis XIV. Anteriormente usaban libreas uniformes solo algunos pequeñísimos cuerpos más palatinos que guerreros, inmediatos á las personas reales como la guardia amarilla, la tudesca, etc. Nuestros soldados de Italia y Flandes vestiánse sí de colores vivos, con plumajes, cadenas y joyeles, pero á capricho de cada uno, haciendo expresa mención las numerosas leyes suntuarias de no quedar sometidos á ellos los soldados á quienes se dejaba en completa libertad de vestirse y adornarse á su antojo, libertad de que usaban y aún abusaban por la profusión de encajes, colores y zarandajas que se echaban sobre sus personas, en cuyo fausto se les distinguía á la legua de la población civil. Véase en apoyo de esto las comedias y novelas de la época.

[8] Relación de lo que montará el sueldo y gasto de cada mes de un ejército, en que haya dos mil y cien caballos y quince mil infantes, llevando doce piezas de artillería con los pertrechos y municiones necesarios, que todo suma ciento treinta y siete mil y cuarenta y cuatro escudos de á diez reales castellanos cada uno. (Clonard, *op. cit.*)

oficiales á más, y hereda algo de los que en él se mueren, y por lo que se ha de gastar agora de presente de golpe y se irá gastando adelante de más de lo que se contase, se ponen mil escudos al mes y aún se entiende que es poco.

Este dato arroja mucha luz sobre nuestra organización sanitario-castrense de aquellos tiempos.

La historia del cuerpo de sanidad militar marcha unida á la del cuerpo de sanidad de la armada en estos tiempos primitivos de organización. Como auxiliares y al servicio de los reyes y príncipes, vemos indistintamente á los médicos y cirujanos figurando en el ejército y en la marina, siendo fieles compañeros y amigos de los monarcas, como Diego del Villar lo fué de D. Alonso VIII, á quien curó de sus héridas en la desgraciada batalla de Alarcos, como Dionisio Daza Chacón, Luis Labera de Avila, Antonio de Guevara y Cristóbal Pérez de Herrera, que tan brillantes servicios prestaron en las campañas de mar y tierra de su época, y, por último, como el ilustre Pedro Virgilii, que siendo cirujano del rey Fernando VI fundó el colegio de San Fernando de Cádiz, orígen de la restauración de los estudios quirúrgicos en España, oyendo del monarca aquella memorable respuesta á su petición: "Reparador de la salud de España, á tu voz van á abrirse mis tesoros, y esa obra fundada por tus manos, dirigida por tí, ha de guardar tus leyes y estatutos." Al colegio de Cádiz fundado en 1748 para el servicio de la armada, siguió el colegio de Barcelona en 1764 para el ejército, de cuyos dos colegios, según algunos historiadores, fué director el mismo Pedro Virgilii: pudiendo estos datos y otros más que sería fácil recojer, corroborar la íntima unión que existía en su principio en los cuerpos de sanidad militar y de la armada, unión justificada por la semejanza de sus servicios.[1]

No debemos pasar tampoco por alto sin citar como predecesores de esta organización en los servicios sanitarios, los que prestaron las órdenes militares de Santiago y Calatrava, así como la hermandad de San Juan de Dios que figura asistiendo á los heridos y enfermos de las tropas, no solo en las guerras contra los moriscos de Granada, sino en la expedición á Tunez, en la conquista de Portugal, en la de las Islas Terceras por el almirante Bazan, y en cuantas campañas de mar y tierra emprendieron nuestros compatriotas en los siglos diez y seis, diez y siete y diez y ocho.[2]

Indudablemente que estos servicios prestados por las instituciones religiosas, que los hospitales fundados en Toledo, Cuenca, Granada y otras ciudades, no revelan una organización perfecta del cuerpo de sanidad militar, pero manifiestan lo que fueron sus primitivos tiempos, confirmando lo que decimos al empezar este trabajo, que la historia del ejército es la de nuestro cuerpo.

No parecerá pues estraño que al intentar bosquejar el origen, organización, y servicios en la Isla de Cuba del Instituto de Sanidad Militar á que nos honramos en pertenecer, tratemos de remontarnos á una época tan lejana cual es el descubrimiento de América. Aunque la flota que condujo al ilustre navegante en su primer viaje no tenía una organización militar verdadera, es indudable que

[1] El colegio de San Cárlos de Madrid fundóse en 1787 por el cirujano militar D. Antonio Gimbernat en vista de los brillantes resultados que en el ejército y en la marina producían los de Cádiz y Barcelona.

[2] Los hermanos Obregones, instituto fundado por Bernardino de Obregón, caballero del habito de Santiago, establecieron varios hospitales en España, extendiendo sus servicios por el Oriente y las Indias, dejando escritos entre otras una Instrucción de enfermos y modo de aplicar los remedios, de gran utilidad para la práctica de los servicios hospitalarios. La hermandad de San Juan de Dios tuvo su orígen en 1543, fundando su primer hospital en Granada de donde se distribuyeron por varios pueblos de la Península, y la buena acojida que le dispensaron los grandes señores, les hizo fundar otras casas en América. Tanto los Obregones como los Juaninos, llegaron á alcanzar gran preponderancia, pues no solo servian en los hospitales, sino que llevados de su celo religioso y amor á la humanidad, acompañaban á nuestras tropas en sus campañas. Análoga institución á la de San Juan de Dios fundó en Mexico, en 1591, Bernardino Alvarez, con el nombre de Hermanos de San Hipólito por radicar en su hospital de este nombre. Se aumentó bastante esta congregación fundando varias casas hospitales en Nueva-España.

aquellas caravelas que señalaron la ruta de los más grandiosos descubrimientos, no iban huérfanas de ausilios médicos; entre aquellos hombres intrépidos y avezados en las luchas, llenos de fé en las palabras del insigne descubridor, no podían faltar algunos maestros en la ciencia de curar. Tanto más debe creerse que así sucediere, cuanto en aquellos tiempos, debido á nuestras guerras con los moriscos, no faltaban maestros cirujanos y médicos en la Península; la medicina era seguida por muchos que sin estudios teóricos obtenían su práctica en los campos de batalla, en las epidemias de los encampamentos, en los sitios de las villas y ciudades.

Al genio previsor de Colón que dispuso sus bajeles, pertrechándolos para tan largo viaje de exploración,[1] no pudo pasar desapercibida la falta de cirujanos que curasen los heridos que era de pensar había de tener en sus conquistas, y que asistiesen en las enfermedades de la mar que tan frecuentes eran en aquellas fechas en las tripulaciones, y de que tan terrible memoria quedó después en otras expediciones, como en la de Vasco de Gama, la de Magallanes, y otras varias.

Tanto más de presumir es que llevasen en sus caravelas medios de atender á sus enfermos, cuando Colón fué aconsejado para emprender su viaje por los padres de la Rábida, á cuyo talento no podían escaparse las necesidades de una empresa tan arriesgada. No es posible fuese desprovista de recursos sanitarios una expedición tan estudiada, cuando la medicina había tomado ya parte en otras anteriores. Por la historia sabemos que en el siglo trece el cirujano Juan Pittard accompañó á San Luis á Tierra Santa; y si bien de la época de que hablamos no se sabe como se prestaba la asistencia facultativa en las naves, ni el orígen, modo, y forma de los nombramientos, se sabe que no faltaban á los expedicionarios de mar y tierra estos servicios humanitarios.[2]

Tampoco podemos considerar á Colón menos previsor que á su competidor Américo Vespucio, que con Alonso de Ojeda y Juan de la Cosa, arribaron en 1499 á Venezuela, y que según Pacheco, "en esta expedición iban provisiones de todas especies, harina, legumbres, objetos de farmacia, artillería, de todo se había reunido en abundancia."

En efecto, corroborando nuestras suposiciones, se sabe que en la Santa María estaba, en 1492, el Maestre Alonso, físico[3] de Moguer, el que sin duda se alistó voluntariamente para aquella expedición, compuesta en su mayor parte de los valientes hijos del famoso puerto de salida. En la lista de tripulantes de la Santa María figura el Maestre Alonso después de los dos pilotos, Juan de la Cosa y Sancho Ruiz, lo que confirma su destino de médico de la embarcación, de la misma manera que en nuestros buques actuales forma el oficial de sanidad después de los oficiales de mar.

Que la primera expedición de Colón no iba huérfana de servicios médicos es tan seguro, cuanto que, entre los 38 hombres que al mando de Rodrigo de Arana dejó el descubridor en el fuerte de Navidad cuando volvió á España inmediatamente después del descubrimiento, había un Maestre Juan, cirujano, buena persona, dice Gonzalo Fernandez de Oviedo,[4] al que más adelante le llama hombre de bien, gentil cirujano.[5] Herrera también lo refiere en sus Décadas,[6] añadiéndo que dejó además entre aquellos hombres un carpintero de rivera, un sastre, un tonelero, un calafate, y un artillero.

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[1] Se sabe que llevaban víveres para un año.

[2] Los reyes y grandes señores fueron siempre acompañados de físicos, médicos, y cirujanos. Vemos en 1625 á Andrés Tamayo nombrado médico de la armada que llevó á D. Fadriquede Toledo á la recuperación del Brasil. Alejo Abreu acompañó á Hurtado de Mendoza en su expedición al Congo y Angola, y otras muchas citas podríamos hacer que creemos innecesarias.

[3] Ya en las siete partidas se llama físico al médico de la hueste.

[4] Historia General de las Indias, Libro II, Cap. VI.

[5] Libro II, Cap. XII.

[6] Década 1a, Libro 1o.

Muchas veces omiten los historiadores tales pormenores, pero debe entenderse que en todas aquellas memorables expediciones de los conquistadores españoles llevaban médicos y cirujanos, máxime cuando no olvidaban ni los más insignificantes detalles en otros puntos de menor interés.

Por otra parte no es posible suponer que aquellos ilustres monarcas de Castilla, tan interesados por la salud de sus tropas que organizaron hospitales militares para la conquista de Granada, dejasen marchar sin asistencia facultativa una expedición á la que contribuyeron tan poderosamente para honra imperecedera de España, é inolvidable memoria de sus preclaros nombres; y efectivamente en la condición décima de las capitulaciones acordadas y firmadas el 17 de abril de 1492 entre Fernando é Isabel y Cristobal Colón,[1] aparece el acuerdo de que hubiese médicos, siendo el primero que obtuvo nombramiento real el Dr. Diego Alvarez Chanca en 1493, que era médico de la princesa primogénita de los Reyes Católicos.[2] No consta que este ilustre médico acompañare á Colón en su primer viaje, pero sí está probado que le siguió en su segundo viaje á América, escribiendo á su regreso una carta al cabildo de la catedral de Sevilla en la que describe las costumbres de los habitantes de la Isla Española ó Santo Domingo, que puede verse en las biografías de este médico, así como en la obra de Fernandez Navarrete, "Colección de viajes y descubrimientos de los Españoles."

Por Real Orden, 6 de Enero de 1501, dada en Sevilla, se previene al Almirante Colón nombrase los facultativos para su escuadra, así como en 1560, por Real Orden 20 de Febrero, se autorizó al Capitán-General del Océano D. Alvaro de Bazán, primer Marqués de Santa Cruz, para expedir los nombramientos de los profesores de los buques de guerra en representación de Su Magestad.

Como digimos anteriormente, estaban unidos los cuerpos de sanidad del ejército y la armada, prestando servicios de mar y tierra, ilustrados médicos y cirujanos que acompañaron las expediciones de Colón, Hernán Cortés,[3] Pizarro y demás intrépidos navegantes, honra de España y admiración de las generaciones posteriores. Por desgracia, la mayoría de los médicos y cirujanos que prestaron sus servicios en aquellas conquistas, han pasado sin dejar rastro en los anales de la historia y solo algunos cuyos escritos se estiman y conservan, como el citado de Alvarez Chanca, pasaron á la posteridad para honra de la medicina militar.[4]

Bién sentimos no poder seguir la historia médica de la primera expedición salida el Viernes, 3 de Agosto de 1492, del puerto de Palos, é indicar las enfermedades y asistencia que tuvieron aquel puñado de aventureros, valientes tripulantes de las frágiles caravelas. Consignarémos sin embargo que la salud de los navegantes debió ser excelente, á juzar por lo que refiere Colón en su diario, pues dice con fecha 27 de Noviembre: "Loado sea Dios Nuestro Señor, hasta hoy de mi gente no ha habido persona que le haya mal la cabeza, ni estado en cama con dolencia, saber un viejo de dolor de piedra, de que él estaba toda su vida apasionado y luego sanó al cabo de dos dias. Esto que digo es en todos tres navios. Así que placerá á Dios que vuestras altezas enviáran acá e venrán hombres doctos y verán despues la verdad de todo."

Poco sabemos más que esto para ilustrar la historia médico-militar de aquellos tiempos, y si hemos citado el hecho de acompañar á Colón en su primer viaje el

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[1] Según hace constar el "Estado general de la Armada" existe este documento en el Archivo Real de Indias de Sevilla.

[2] Cartas autógrafas de D. Fernando y Da. Isabel á dicho médico.

[3] Este ilustre conquistador tenía el mayor cuidado con sus heridos como puede comprobarse leyendo á Solís (Conquista de Méjico). Como es sabido acompañaba á Cortés Fr. Bartolomé Olmedo que poseía la medicina, siendo tal la aficion á curar entre la tropa que Solís, Herrera y Bernal Diaz del Castillo hablan de un soldado, Juan Cathalan, que hacía curas maravillosas en los heridos, citando también hasta una muger, Isabel Rodriguez, que obró curas admirables.

[4] Hernandez Morejón se estiende sobre el mérito de Alvarez Chanca, primer médico que estudió las costumbres y enfermedades de los Indios.

físico de Moguer Maestre Alonso así como el Maestre Juan, y en el segundo el Dr. Alvarez Chanca, ha sido para corroborar nuestras primeras palabras, que doquiera han ido tropas españolas no ha faltado asistencia médica, generosa y humanitaria.

Las condiciones estipuladas por los Reyes Católicos y el Almirante, las sabias disposiciones que se siguieron encomendando á los generales del océano los nombramientos de médicos y cirujanos, señalan los primeros albores de la medicina militar en América, y aunque sin la organización perfecta de los ejércitos del dia, se mostraba á la altura de aquella época.

No dejaremos de consignar que al regresar Colón á la Española en su segundo viaje, habia perecido casi toda la guarnición que dejara en el fuerte de Navidad, figurando entre los muertos el Maestre Juan, que podemos considerar como el primer médico militar que rindió su tributo al clima Americano, pues según historiadores de crédito, puede deducirse que aquella guarnición fué diezmada por la fiebre amarilla endémica desde antes del descubrimiento.

Para terminar, conviene no echemos en olvido la gran parte más ó menos directa que tuvieron los médicos en el descubrimiento del Nuevo Mundo. Sabido es que el ilustre genovés consultó su grandiosa empresa con el físico florentino Paolo Toscanelli, el que le dirigió varias cartas sobre el particular "dando causa en gran parte á que el Almirante emprendiere el viaje con mas ánimo," según dice su hijo, Dr. Fernando.

Cuando Colón propuso á D. Juan de Portugal la empresa gloriosa que estaba reservada á la corona de Castilla, aquel monarca encomendó el estudio del negocio á D. Diego Ortiz de Calzadilla, Obispo de Ceuta, gran cosmógrafo, y á Maestre Rodrigo y Maestre Jusepe, médicos judíos á quienes él daba crédito en cosas de descubrimiento y cosmografía.[1]

Cuando después de varios años de inútiles pasos cerca de la reina católica, Colón se aloja descorazonado con ánimo de proponer el descubrimiento al rey de Francia, el guardián de la Rábida, Fr. Juan Perez, que de ninguna manera quiso que los reyes perdiesen la ocasión de aumentar sus dominios, detuvo al navegante en su convento y celebró junta con el físico Garci-Hernández, de la que resultó el armamento de las caravelas, siendo este modesto médico de Palos quien decidió por sus conocimientos cosmográficos al memorable Fr. Juan Perez que conocía á la reina, para que la augusta señora prestase su cooperación á la más grandiosa empresa que consignará la historia del mundo.

Mucho se ha escrito sobre estos acontecimientos con motivo del reciente Centenario de Colon. En folletos, conferencias y libros se han tratado y discutido las personalidades mas prominentes que han figurado en aquel período de la historia de España, que son páginas de la historia de la humanidad entera, pero de lamentar es que no hayan sido ensalzados como se debiera, y colocados en su verdadero lugar los médicos que prestaron su cooperación al gran navegante.

Los nombres de los maestres Juan, Alonso, Rodrigo, Jusepe, y Garci-Hernández suenan de pasada en todos los escritos históricos de esta época, pero de la biografía de estos médicos apenas se ha ocupado la posteridad, teniendo pendiente esta deuda de honor nuestros historiadores médicos contemporaneos.

Al evocar ante el gran Congreso Pan-Americano los nombres de los primeros médicos que pisaron las tierras del Nuevo Mundo, mi ánimo es que olvideis el poco mérito de mi disertación, pues necesariamente tendreis que abstraeros pensando que si mérito contrajo Colón al atravesar desconocidos mares en las frágiles caravelas cuyos diseños contemplamos hoy en las aguas del lago Michigan, no menor mérito debemos conceder á los Maestros Juan y Alonso, y al Dr. Diego Alvarez

[1] Estos dos físicos eran médicos de la corte del Rey D. Juan II, y tomaron gran parte en la reforma del astrolabio, sin cuyo instrumento náutico no hubiera podido intentarse atravesar el océano.

Chanca Al Almirante le guiaba la fé y confianza en su estudiada empresa, y la aspiración á una gloria cierta; y nuestros médicos iban impulsados tan solo por la generosidad en prestar sus humanitarios servicios. Saludemos pues sus nombres. Honremos la memoria de los que nos precedieron en el ejercicio de la medicina en América.

THE CLIMATE OF JAMAICA, WEST INDIES.

By JAMES CECIL PHILLIPPO, M. D.

Jamaica is an island in the Caribbean Sea, situated south of the islands of Cuba and Hayti, between and in sight of which vessels from the United States and Canada must pass in order to reach it, and is about six days' voyage by sea from New York and three from Tampa Bay or St. Augustine, in Florida. It is about 140 miles long and 49 at its greatest breadth, having safe and convenient harbors all round it, to which two or three coasting steamers make weekly visits and which fruit steamers from New York, Boston, and Baltimore are continually visiting for cargoes of bananas, oranges, pineapples, cocoanuts, sugar, rum, and coffee, dyewoods, pimento, and other tropical products. A strip of level land, several miles in breadth in some parts, lies along the coast, which is partially cultivated as sugar estates and banana and grazing properties; while the interior is exceedingly mountainous, with deep gorges and fertile valleys. The higher mountains are covered to their summits with evergreen woods and occasional coffee properties, and the lower with grazing farms, pimento walks, orange groves, and cocoa, tobacco, and ginger plantations. In fact, vegetable productions of all kinds are to be found in this island according to the altitude in which they best thrive, for while the cocoanut, sugar cane, and pineapple thrive best in the lowlands, oranges, limes, lemons, mangoes, and breadfruit do better at higher altitudes, and coffee, onions, potatoes, ginger, nutmegs, and cinnamon on higher altitudes still. Cinchona, peach, and apple trees do best on the highest lands, and the strawberries run wild as weeds. According to Mr. Harrison, the late Government surveyor, there are about 2,000 square miles of land lying along the coast, and rising to 1,000 feet of altitude; 1,451 square miles between 1,000 and 2,000 feet; 400 miles between 2,000 and 3,000 feet; 74 miles between 3,000 and 4,000 feet; 39 miles between 4,000 and 5,000 feet, and 24 miles between 5,000 and 7,000 feet; and plantations for the growth of various products are to be found in all these districts. The temperature varies with the altitude, as in all other countries, but snow is never seen even at the greatest altitude, and although ice has been found and the temperature has been at the freezing point at the highest peak, no one has been there at the time to feel it. Though the temperature varies to some extent, the daily variation is never great. The inhabitants can change their temperature environment according to their inclination or their necessities, but are not obliged to adapt themselves to the changes of temperature. Even in the highest mountains fires in the house are not really necessary. Throughout the year the variation is not greater than 17°, on an average, in the lowlands, being in the winter months about 10° lower than in the summer. Kingston is the chief town and port on the island, and is the hottest place on it. The weather reports from 1880 to 1889 give the mean daily average taken at 7 a. m. and 3 p. m. in the shade at 78°, the highest mean temperature during these years being 86° and the lowest 68°. Of course there are times when the thermometer goes up to even 94°, but such a rise is rare and lasts but a short time. On the north side of the island the thermometer on the seaboard is generally lower even than on the south, and the nights are always cooler than the days. This moderate heat

will seem strange to those who experience the intensely hot days in the Northern States, where not unfrequently the heat is much greater; but it is explained by the fact that Jamaica, being an island, is subject to the influence of the sea and land breezes. The cooler air from the sea rushes in to take the place of the hotter and rarefied air which rises from the heated land during the day, and the cool air from the land, which cools more rapidly than the surrounding sea, rushes down to take the place of the warmer and more rarefied air which arises from it at night. Thus the greater the heat of the land in dry weather the stronger are both the sea and land breezes. On an average taken for over twenty years it is found that there are not more than fifteen calm days in the year, the sea breeze generally rising at about 10 or 11 a. m., keeping up at a velocity of from 2.6 to 8.4 miles per hour until 5 or 6 p. m., when it ceases generally until the land breeze comes down at about 8 p. m. with somewhat less velocity and lasts until 7 a. m., 3 to 4 a. m. being the coolest period. The temperature decreases, too, with the elevation, a few hundred feet making a considerable difference, the barometric pressure being less. Thus within 5 miles of Kingston we find at an elevation of 300 feet a marked difference in the temperature. Ice, which is almost a necessity in the town, is by no means so there, porous jars being sufficient to make the water passably cool. At the botanical gardens, situated at Castleton, about 19 miles from Kingston on the north side of the Central Mountain range, where there is a rainfall of over 100 inches per annum and an altitude of about 1,200 feet, American tourists have not found an ulster uncomfortable in January, our driest month, and in our winter months the European troops at the military camp of New Castle at an altitude of 3,800 feet are glad to make use of two or three blankets at night. The rainfall varies considerably in different years, in different months of the year, and in different parts of the island. The northern slopes of the central chain of mountains have a much greater rainfall than the southern, the months of May, June, and October having the largest, and January, February, and March the smallest rainfall; and as tropical fevers and other diseases are most prevalent immediately after the heavy spring and autumnal rains, these latter months are the healthiest, coolest, and most pleasant of our seasons, though, as I have already shown, it can not be said that any part of the year is very hot or unpleasant, nor, as I shall presently show, very unhealthy. A reference to the observations and tables annexed taken from the last report of our Government meteorologist will, however, give in a more concise degree than I can a clear idea of these matters.

The name of the island is derived from two Indian words, Xay-mahica, meaning the land of wood and water, in both of which it truly abounds, for not only are the pastures covered with indigenous pimento and exotic mangoes and breadfruit, but its river courses, roads, and mountain sides are clothed with bamboos and palms and undergrowth of all kinds; but ferns, from the tiniest maidenhair to forests of tree ferns, are to be seen on the higher slopes of the mountains, and springs are to be found in all directions on some parts of the island, though absent in others. Of these there are several which possess valuable medicinal properties. There are hot sulphuro-calcic, warm sodic calcic, cold sulphur, cold chloride of calcium, and ferro-aluminous saline springs. Only four of these, however, are of established reputation. Of these, two are supported by the Government and managed by local boards, and one, the alumino-ferric saline, though owned by the Government, is in but small request. The one most used and most esteemed is situated under a hill near the banks of the Milk River, and is about 7 miles, by a good driving road, from a railway station about 36 miles from Kingston, and, therefore tolerably easy of access. It is a thermo-calcic saline spring, with a temperature of 92° F., and has been found especially useful in the cure of gout, rheumatism, neuralgia, and some forms of paralysis and peripheral neuritis, and is

very similar to the waters of Carlsbad and Kissengen. I have known persons suffering from gout and chronic rheumatism, unable to move from their chairs, who have been carried into the bath, and who have after three or four baths not only been able to walk and get into it, but have been able even to go and dine out with friends in the neighborhood within a week. The accommodation at this place is not very grand and the diet is not very varied, though it is good and nutritious. The bath of St. Thomas, in the east, is truly a hot sulphuro-calcic water, similar to the waters of the Eaux-Bonnes, and superior to those of the Eaux-Chaudes, in the Pyrenees, described by Pajot as being so useful in the early stages of phthisis. These springs have a temperature of 128° at their source, the steam rising from them as they run down the valley, while quite near them are cold springs, with which the hot waters are diluted for the baths. The bath-house is small but clean and comfortable, and the baths, four in number, are kept in good order, though with none of the apparatus or skilled attendance necessary to develop its healing qualities to their greatest extent. They have, however, proved wonderfully useful in the cure of gout, rheumatism, neuralgia, and cutaneous diseases, especially of a specific character, and have been and still are much esteemed. They are not so easily reached as the others and, therefore, are less visited; but as they are situated in a singularly beautiful tropic gorge, surrounded by wooded mountains, they will well repay a visitor, and he will find simple lodgings in a modest little village, with its grove of otaheite apples and spathodias near it. Begonias and ferns line the road from the village to the springs, and mango trees, breadfruit, bananas, and palms overhang it, while two nutmeg trees form the portals of the baths. The ferro-aluminous saline spring is situated at an altitude of 3,500 feet, not far from the military encampment at New Castle, the road to which lies through the far-famed fern walk. It is well worthy of attention, having a larger quantity of iron in it than some of the springs of Harrowgate, in England, which are highly esteemed, but contain no alum, and are very similar to those of a like character in Virginia. Unfortunately, they can be reached only on horseback, and there are no buildings about them for the use of travelers or patients.

In such a climate as this the wonder is that it has had such a bad reputation for fevers, but this is easily explained by recalling to mind the facts of its early history, which show a total want of ordinary care and attention to the simplest hygienic laws. In this, however, Jamaica is not singular, for older communities have suffered from the plagues, sweating fever and cholera, and many of the cities of these States, not even excepting New York, have not so very long ago suffered from epidemics of yellow fever from like causes.

Jamaica in its earliest days was colonized by troops and settlers of the worst classes of Great Britain, and was visited by the buccaneers, who spent their unlawful gains in rioting and drunkenness. The European troops were moreover located in what were at the time good strategical positions, generally in malarious and unhealthy localities, and were overcrowded in unventilated barracks; and the sailors were for months located in harbors surrounded by marshes near the embouchures of rivers, which supplied them with impure water, which they mixed with the new rum of the country. They were exposed in open boats to the heat of the noonday sun and slept after a hard day's work on the decks of their ships, or, if too drunk to get on board, on the malarious shore. The European mechanics and overseers, too, on the sugar estates were worked day and night in the fields and in the boiling and still house, had bad food and poor lodgings, and drank freely of the rum they manufactured, for they had no domestic ties and no comforts, nor care in sickness, and fell victims in large numbers to their bad habits and surroundings. But within the last fifty years great changes have taken place for the better. Yellow fever is no longer an epidemic and can scarcely be called an endemic disease in Jamaica, for a due

attention to hygienic law has led to the improvement of the towns. There are no large unacclimatized European populations, no tenement houses, closes, or wynds in which yellow fever may, by concentration, become infectious; the streets and courtyards are kept clean; and the water supply is brought down from clear mountain springs, the banks and sources of which are under police supervision. The European soldiers have been moved to higher and healthier localities and are out of the reach of low rum shops and other places of dissipation, and the sailors are better cared for than in former days. The old sailing ships which used to remain months in the ports have been supplanted by steam vessels which remain but for a few days, and the hard work of loading and unloading sugar, rum, and other articles of import or export is performed by steam winches and negroes, while the harbors and towns are kept under strict sanitary supervision.

Half a century ago, according to Brigade Surg. Maj. Maimsell, who has lately given us a brief account of his researches in the medico-military statistics of the colony, 3 soldiers out of 4 stationed in Jamaica were twice a year in the hospital, and 12 per cent died, five-sixths of them of fever; while in the last two decades we find that from 1870 to 1879 there was an average of 5 deaths per 1,000 and 13.79 admissions into hospital; from 1880 to 1889, 4 deaths and 11 admissions, and in 1889 the deaths from all causes amounted to 4, from fever none, and admissions but 11.36. In the civil population there has been the same improvement, for whereas in the early part of this century yellow fever was constantly occurring, it is now comparatively rare. During the last ten years there have been but 96 cases, of whom but 2 were passing strangers out of 16 civilians who died of it, the rest being soldiers and sailors, most of whom brought it with them or took it from those arriving from foreign ports. A strict quarantine is now maintained, and other provisions are made to prevent the introduction of epidemic diseases. Should any be introduced by any means, they can be easily isolated, and thus rendered innocuous to the community, for the acclimatized negroes, Hindoos, and Chinese are not amenable to yellow fever, nor even the white population, who, moreover, live in separate houses and are not of the class that live massed together. Phthisis of course is present, as it is in even the most favored localities in Europe and America to which its victims resort. It is not uncommon in Nice and Mentone among those who are brought up in those places. But in Jamaica it exists principally among the poorer classes, who live in unventilated and overcrowded towns, and is rare among the upper classes. The annual mortality from this disease during the last twenty years was 1.7 per 1,000 for the whole island. Kingston, which is the chief town and resort of a great number of the weak and destitute and idle from all parts of the country, supplies the largest number, while one parish which comprises a good stretch of both low and mountain lands gives a death rate from this disease of 0.8; Santa Cruz, which lies in its mountain district, having had 0 per 1,000 for several years. There are other diseases, but the mortality on the whole has not been more than 22 per 1,000 for the last few years, and but 21 in the last year and in this, 44 per cent of these being children under 5 years.

A residence from childhood in Jamaica enables me to speak with some authority on both its climate and its health, and I may therefore say in conclusion and with confidence that it offers greater inducements to the American in search of a winter resort than can be found in any other part of the world: for not only is the voyage shorter and easier, but invalids can obtain, within a radius of a few miles and of a few hours' journey from their arrival at their landing place, dry mountain situations with cheerful aspects, extensive views of tropical scenery, an invigorating, stimulating atmosphere suitable to the hypochondriac and dyspeptic, and moist mountain situations for the nervous and those who suffer from a dry and irritable condition of the air passages; dry inland and seaside situations for the

leuco-phlegmatic and those who suffer from copious bronchial discharges; saline and sulphurous baths for the rheumatic and gouty, and chalybeate springs at high elevations for the anæmic; and above all and everywhere he can, while his friends at home are shivering in close chambers, lead an outdoor life, inhaling the free air of the mountains under a cloudless sky.

Meteorological results, etc., at Kingston, for the ten years from June, 1880, to May, 1890.

[By Maxwell Hall, M. A., F. R. A. S., F. R. M. S.]

Month.	Barometric pressure.	Temperatures.				Wind SE., miles per diem.	Vapor.		Cloud.	Rainfall.		Infantile diseases.	Lung diseases.	Fever.	Dysentery and diarrhœa.	Various	Total.
		Mean.	Max.	Min.	Range.		Dew-point.	Humidity.		Kingston.	The island.						
	Inches.	°	°	°	°		°		*P.c.*	*In.*	*In.*						
Jan	30.054	74.6	86.4	66.8	19.6	68	66.7	78	29	0.96	3.87	21	19	10	9	58	117
Feb	30.049	74.7	85.8	66.8	19.	72	66.7	78	27	0.32	2.62	24	14	8	12	53	111
Mar	30.034	75.8	85.7	67.8	17.9	77	67.6	77	29	1.59	2.88	32	17	7	15	68	139
Apr	30.008	77.9	86.5	69.8	16.7	68	69.1	75	39	1.02	4.18	27	16	9	15	55	122
May	29.979	79.4	87.2	72.4	14.8	74	71.4	78	56	6.	8.40	22	15	8	14	60	119
June	30.	80.8	88.5	73.8	14.7	115	72.8	78	57	5.51	7.83	16	14	9	11	54	104
July	30.024	81.1	89.7	73.5	16.2	103	72.5	76	52	2.15	4.32	18	18	11	7	57	111
Aug	29.983	80.4	89.4	73.2	16.2	80	73.	79	55	4.09	6.83	12	15	9	4	50	90
Sept	29.956	80.1	89.7	73.3	16.4	70	73.1	80	62	3.59	6.86	11	12	7	2	47	79
Oct	29.937	78.9	88.9	72.1	16.8	56	72.2	81	58	4.69	7.84	13	14	7	4	54	92
Nov	29.962	77.8	88.9	70.7	18.2	53	70.1	78	44	1.22	5.07	17	15	10	4	57	103
Dec	30.005	75.7	87.	68.4	18.6	57	68.	78	38	1.50	5.60	16	16	10	6	59	107
Means.	29.999	78.1	87.8	70.7	17.1	89	70.3	78	55	.....	.....	19	15	9	9	56	108
Total.	.....	.....	.....	.....	.....	....	.....	....	.	32.64	66.30	....	....	....	....	....	....

The table above contains the results of the observations made at Kingston, Jamaica, between June, 1880, and May, 1890, inclusive. Between June, 1880, and December, 1886, the readings were taken at intervals of eight hours, namely, at 7 a.m., 3 p.m., and 11 p.m., local mean time; the daily means of pressure, temperature, dew-point, humidity, etc., were assumed to be the means of the three eight-hourly readings, but since January, 1887, the readings have been taken at 7 a.m. and 3 p.m. only; and the daily means were deduced by applying to the 7 a.m. and 3 p.m. readings their proper reductions; and from the daily means the monthly means given in the table have finally been deduced. The readings were taken with great care and regularity, and they were all corrected for instrumental errors.[1] In the second column the barometric pressure is of course referred to the sea level. In the seventh column the wind is stated to be southeast, and this is in consequence of the regularity of the daily sea breeze, which is almost invariably southeast at Kingston. In the eighth column the dew-point has been found from the dry and wet bulb thermometers by means of Glaisher's factors; of course, wet-bulb and tension-of-vapor columns could have been added, but it seemed useless to fill up the table with columns easily deducible the one from the other. In the tenth column the amount of cloud is given as a percentage of the whole sky. In the eleventh and twelfth columns are given for the period in question the average monthly rainfall at the public works office, Kingston, and for the whole island—the latter being deduced from about 150 stations. The remaining columns give for each month the average number of deaths in Kingston from a few groups of diseases, and the average totals; they have been taken from the returns published monthly by Mr. S. P. Smeeton, the registrar-general.

[1] The thermometers were exposed in the Stevenson screens over a grass lawn, 4 or 5 feet above the ground.

The following are some of the relations existing among the different columns:

Pressure and rainfall: If the barometric pressure be compared, not with the Kingston rainfall on account of its highly local character, but with the general island rainfall, it will be seen that a certain relation exists: Rainfall = 50 (30.100 — pressure), or, in other words, if the pressure during any month be subtracted from 30.100, and if the difference be multiplied by 50, the product will not be far from the rainfall in inches. This remarkable relation requires much further consideration, for which we have at present neither space nor time.

Temperatures: The mean temperature does not greatly differ from half the sum of the maximum and minimum temperatures. In order to make the agreement closer we must take into account the range, or difference between the maximum and minimum, the humidity, and the amount of cloud which covers the sky. The maxima and minima given in the table were deduced from daily readings, and their differences give the daily range; but by picking out of the original record or register the highest and lowest temperatures for each month we get the absolute maximum and minimum. To prevent confusion the absolute maximum and minimum were not inserted in the table; their averages are, however, 4° above and below the maximum and minimum deduced from daily readings. Again, in the interval between June, 1880, and May, 1890, the highest temperature was 96.1°, recorded on the 12th September, 1880, and the lowest temperature was 56.7°, recorded on the 4th December, 1887. And lastly the mean daily temperature is here given for each complete year: 1881, 78°; 1882, 78.2°; 1883, 78.2°; 1884, 77.8°; 1885, 78.9°; 1886, 78.2°; 1887, 77.2°; 1888, 78.5°; 1889, 78.5°.

Vapor: The humidity of the air is the ratio of the amount of vapor present to the amount necessary for saturation—saturation being taken as 100; so that humidity indirectly measures the drying power of the air.[1] By comparing the dew-point with the minimum temperature we see that there is an almost constant difference of about half a degree. The nights in Kingston, therefore, cool down until the temperature of the air 4 or 5 feet above the ground is a little above the dew-point; but on the ground the temperature is below the dew-point, dew is precipitated, latent heat given out, and the further fall of temperature arrested. We must now consider the connections between these meteorological results and the number of deaths in Kingston.

Infantile diseases: Under this heading is given the number of deaths in Kingston each month of the year from infantile diseases not otherwise specified in the books of the registrar-general. By comparing the numbers in this column with the total monthly numbers in the last column, it will be seen that the former are fairly proportional to the latter, although, indeed, their variation from their mean or average is larger. Consequently, whatever cause systematically affects the total monthly numbers, the same cause affects young children rather than adults.

Total monthly numbers: The total number of deaths vary on the average with considerable regularity from month to month; the maximum, 139, occurs in March; the minimum, 79, occurs in September. This variation is intimately connected with the temperature; and remembering that there must always be a considerable interval of time between such a cause and such an effect, it appears that the maximum occurs after the lower temperatures, and that the minimum occurs after the higher temperatures; or, in other words, the death rate greatly increases after our cool season, and greatly diminishes after our warm season. As in the year 1881 there were in Kingston only 5,000 white people out of a total population of 38,566, it is to the black and colored people that the above result chiefly applies; and again, as the fall of temperature during the cooler months is really very small, the large increase in the number of deaths must be chiefly due to the lives led by many of the poorest

[1] If the drying power of the air were measured from 0 to 100, humidity plus drying power, would always be 100.

people—to their sleeping under open sheds and dilapidated roofs: and it would therefore seem possible to reduce the Kingston death rate in the course of time.

Fever: There are but few deaths from this cause, and they are distributed throughout the year with considerable uniformity. One maximum occurs in July after the May rains, and another occurs in November, December, and January after the October rains. These maxima are due to malaria set free by the drying-up of the ground after heavy rains. In many countries in the tropical parts of the earth it is dangerous to disturb the soil—as, for instance, in the Gold Coast Colony in Africa—because the soil teems with malaria; and so it must have been in the earlier days of Jamaica when the land was first cleared of forests and when the soil was first turned up for the cultivation of the sugar cane: but now, we, for the most part, only feel the effect of water returning upward from considerable depths below the surface of the ground; for with the water ascend those specific disease germs which produce malarial fever when they can secure a footing in the blood and develop specific organisms.

The germs of these organisms float about in the air from place to place and gain positions enabling them to enter the blood of some animal organism, say man, where they can grow and flourish, provided they are able to successfully encounter their mortal foes, the white corpuscles of the blood. If these white corpuscles are strong and vigorous, they will overpower the foreign growth and kill it. If, on the other hand, they are weak and feeble, and the germs very numerous, the foreign growth may get a secure footing and spread luxuriantly, changing the character of the fluids of the body, coagulating, it may be, the albumin, and otherwise setting-up the unnatural and abnormal display of functions which we call disease.[1]

We have thus dwelt upon the cause of malaria in places which may be far removed from swamps and morasses, not on account of its importance to Kingston, but because of its widely spread influence in Jamaica.

Lung diseases: The number of deaths from this cause is tolerably constant throughout the year. A maximum occurs in January, and another in July: but after both these maxima there seems to be a small reaction, and the minima speedily follow.

Dysentery and diarrhœa: Deaths from these diseases are intimately connected with the minimum temperature; a few cold nights in Kingston are certain to produce either or both these diseases; and their virulence depends upon the extent to which the temperature falls. But some allusion must be made to predisposing causes, of which rain seems to be the most important in Jamaica; the people get wet and do not change their clothes, a cold night sets in, and disease is the immediate consequence. Thus there were rains in December, 1880, which produced dysentery and diarrhœa in January, 1881: but it was not until the cold nights of January that these diseases became serious and caused the death of 72 persons during the three following months. Again in December, 1881, and the early part of 1882 there were no rains and very little dysentery and diarrhœa. We must not expect to find complete agreement between our meteorological returns and those of the registrar-general; but we hope that the outlines of the agreement have been correctly sketched, and that the importance of the subject has been duly pointed out.

The island rainfall: The rainfall is now fairly well registered in Jamaica, almost entirely by voluntary observers; but unfortunately the gauges are very unequally distributed over the island. To meet this difficulty the island is divided into four divisions, and month by month the rainfall is deduced for each division, the island rainfall being simply the mean of the four divisions. It appears that while the May and October rains are everywhere strongly marked, the northern part of the island has winter rains in November, December, and January, the southern part has summer rains in August and September, and each part is further divided by the amount of rainfall, thus giving the four divisions. The northeastern division

[1] Nature, vol. 31, p. 267.

is cut off by a straight line drawn from Port Morant to St. Ann's Bay; it includes the lofty range of the Blue Mountains, and their continuation as the hills of St. Mary; it faces the rain-bringing winds of winter, and it has a large rainfall in November, December, and January, as well as in May and October. This division has the greatest annual rainfall. The northern division includes the parishes of St. Ann, Trelawny, and St. James. It is that part of the island which lies to the north of those broken ranges of hills which run through the center of the island in a direction more or less parallel to the Blue Mountain range. The annual rainfall is less than in the first division, but it has the same characteristics. The west central division stretches in the same direction from Chapelton to Green Island. It is deprived of the greater part of the winter rains by the two former divisions, whose hills precipitate the abundant vapor in the east-northeasterly winds; but it has well-marked summer rains in August and September, as well as the usual rains in May and October. It has a larger annual rainfall than the northern division. The last and southern division has the same characteristics as the third, but the annual rainfall is much smaller.

In the preface to Sir Hans Sloane's Natural History of Jamaica we find that he alluded to the May and October rains; to the winter rains on the north side, to the summer rains on the central hills, and to the small rainfall on the southern plains. Consequently the characteristics of the rainfall have not altered for at least two hundred years. This leads us to the consideration of the constancy of the amount of rainfall, and at length we are able to give some information on this important subject. According to the two following tables the average rainfall over the island was about 67½ inches for the first decennial period from 1870 to 1879, while for the second decennial period from 1880 to 1889 the average rainfall over the island was 66½ inches, or one inch less. But as these results are greatly effected by "flood" rains, the only wonder is that they are so nearly equal. Again, it will be seen that there has been a curious increase in the rainfall in the second decennial period in the west central and southern divisions, while there has been a larger decrease in the northeastern and northern divisions, as though the whole rainfall system had been shifted more to the south. All such variations are for the most part temporary, and the present decennial period may show just the opposite.

The rainfall over each division from 1870 to 1889.

Year.	Rainfall divisions.				The island.
	NE.	N.	WC.	S.	
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
1870	110.60	83.09	102.98	61.07	89.43
1871	69.45	41.88	54.56	34.46	50.09
1872	59.42	40.79	51.50	29.02	45.18
1873	84.08	52.64	67.79	47.71	63.06
1874	97.18	68.25	62.97	47.35	68.94
1875	71.89	47.15	56.16	34.47	52.42
1876	90.38	54.71	87.33	52.99	71.35
1877	100.72	56.53	64.06	52.27	68.40
1878	104.12	62.99	72.44	66.11	76.42
1879	122.55	65.44	87.54	79.85	88.84
Means, first decennial period	91.04	57.34	70.73	50.53	67.41
1880	76.37	47.01	64.91	33.47	55.44
1881	91.24	49 42	75.32	58.42	68.60
1882	65.48	43.76	78.59	43.67	57.87
1883	72.30	41.52	78.19	45.02	59.26
1884	69	41.87	73.10	43.63	56.90
1885	70.55	52.77	72.62	43.52	59.86
1886	126.61	60 98	88.21	86.64	90.61
1887	80.25	61.07	80.14	61.16	70.66
1888	98	54.42	70.43	65.58	72.11
1889	99.81	56.82	75.94	64.02	74.15
Means, second decennial period	84.96	50.96	75.74	54.51	66.54

The island monthly rainfall from 1870 to 1889.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1870	3.99	4.35	3.10	2.79	17.38	3.58	4.33	5.72	8.05	16.74	12.50	6.90	89.43
1871	2.40	1.60	2.29	3.46	6.43	1 98	3.79	3 46	5.70	8.88	5.88	4.22	50.09
1872	3.	2.84	3.06	2.06	5.18	2 41	2.89	5.24	4 55	6.09	3.13	4.73	45.18
1873	8.15	1.94	5.47	1.15	5.06	2 58	2 56	7.51	10.73	8.57	3.53	5.81	63.06
1874	3.44	2.20	0.61	4.40	10.65	3.96	2.51	9.65	6.82	11.69	10.52	2.49	68.94
1875	2.57	0.67	2.59	3.05	8.54	3.74	3.87	5.13	7.60	5.58	2.34	6.74	52.42
1876	6.	0.96	1.63	4.68	8.24	5.40	8.15	5.06	5.19	11.36	8.96	5.72	71.35
1877	5.94	1.18	5.38	2.91	15.03	6.50	4 68	1.76	5.01	4.50	7.63	7.88	68.40
1878	6.35	2.80	2.78	0.70	4.86	6.63	5.85	10.80	7.43	11.29	7.32	9.61	76.42
1879	2.81	5.30	6.49	7.28	9.14	10.64	4.47	12.32	7.38	15 96	5.29	1.76	88.84
Means	4.46	2.38	3.34	3.25	9.05	4.74	4.31	6.66	6.85	10.07	6.71	5.59	67.41
1880	4.36	0.96	1.10	2.77	11.60	3.09	3.86	9.58	3.97	4.	2.21	7.94	55.44
1881	1.22	4.01	1.30	4.63	10.28	5.56	4.77	6.21	7.68	12.08	7.52	3.34	68.60
1882	2.92	1.93	3.54	3.32	8 22	2.33	3.76	4.80	8.78	8.96	5.36	3.95	57 87
1883	5.49	3.50	4.08	3.34	5.29	4.98	3.15	5.42	7.82	8.15	5.12	2.92	59.26
1884	4.72	3.44	2.51	1.85	6.72	6.89	2.52	5.06	6.23	9.52	5.	2.44	56.90
1885	1.73	1.49	1.47	4.73	4.90	3.32	3.01	6.19	6.22	6.37	4.74	15.69	59 86
1886	5.23	4.65	2.68	6.39	5.30	23.36	6.22	13.54	5.90	7.98	3.70	5.66	99.61
1887	6.02	2.32	2.38	4.47	9.32	8.89	7.19	6.91	5.77	8.47	8.17	0.75	70.66
1888	1.36	1.89	1.70	3.61	21.24	6.77	2.65	5.47	8.10	4.38	4.59	10.35	72 11
1889	4.78	0.90	4.19	6.71	7.82	12.52	6.08	5.12	8.20	10.49	4.37	2.97	74.15
Means	3.78	2.51	2.49	4.18	9.07	7.77	4.32	6.83	6.87	8.04	5.08	5.60	66.54

Kingston, Jamaica, mean results for the year 1891.

[Elevation 60 feet.]

Month.	Means for the month.												
	Pressure.		Temperature.					Dew-point.		Vapor.		Humidity.	
	7 a. m.	3 p. m.	7 a. m.	3 p. m.	Max.	Min.	Range	7 a. m.	3 p. m.	7 a. m.	3 p. m.	7 a. m.	3 p. m.
	In.	*In.*	°	°	°	°	°	°	°	*In.*	*In.*	°	°
Jan	30.050	29.992	68.4	83.6	86.8	66.5	20.3	63.3	68.1	0.582	0.687	84	60
Feb	30.052	29.975	69 6	83.9	86.7	66.9	19.8	62.7	66.1	.570	.641	79	55
Mar	30.024	29.954	70.4	82.9	85.8	67.4	18.4	63.6	67.2	.588	.666	80	59
Apr	29.995	29.934	74.9	84.6	86.3	71.9	14.4	67.5	69.5	.673	.721	78	61
May	29.980	29.930	77.1	85.2	87.	73.1	13.9	69.7	71 3	.726	.766	78	63
June	29.964	29.916	79.	85.9	87.7	74.9	12.8	70.6	72 6	.749	.801	76	65
July	30.009	29.960	78.6	88.6	90.4	75.	15.4	68.8	70.6	.704	.749	72	56
Aug	30.002	29.960	76.8	85.6	91.2	74.5	16.7	69.8	72.8	.728	.807	79	66
Sept	29.975	29.922	76.9	85.6	89.4	74.4	15.	70.3	74.4	.741	.851	80	69
Oct	29.920	29.867	75.6	83.2	87.1	74.	13.1	70.4	72.6	.744	.801	84	71
Nov	29.964	29.908	72.7	83.6	84.1	69.3	14.8	69.2	70.8	.713	.754	88	66
Dec	30.039	29.978	69.8	84.	87.1	69.4	17.7	64.5	68.	.607	.684	83	59
Means	29.998	29.941	74.1	84.7	87.5	71.5	16	67.5	70.3	.673	.741	80	62

The barometric pressure is the reading of the barometer corrected for instrumental error and reduced to 32° and sea level.

Kingston, Jamaica, mean results for the year 1891—Continued.

[Elevation 60 feet.]

Month.	Means for the month.				Extremes for the month.					Total rainfall.	Remarks.
	Cloud (percentage).		Wind.		Temperature.						
	7 a. m.	3 p. m.	From	Miles daily.	Max.	Date.	Min.	Date.	Range		
					°		°		°	In.	
Jan	13	48	SE.	53.9	90.4	7	61.5	27	28.9	0.41	Fair, light shock of earthquake, 6:30 a. m., 27th.
Feb	30	40	SE.	127.1	90.2	1	63.6	5	26.6	0.27	Fair, light shock of earthquake, 3 a. m. 16th.
Mar	25	42	SE.	73.5	91.4	15	63.2	3	28.2	0.04	Fair.
Apr	31	53	SE.	70.	89.1	25	68.4	2 and 3	20.7	1.25	Fair.
May	48	63	SE.	63.5	91.	30	69.9	23	21.1	2.03	Fair.
June	50	74	SE.	112.7	90.9	5	72.2	8	18.7	6.47	Fair.
July	38	62	SE.	116.7	96.1	13	72.	1	24.1	0.49	Fair.
Aug	44	74	SE.	69.8	96.7	20	70.	29	26.7	3.08	Fair, absolute maximum temperature in past 11 years.
Sept	56	84	SE.	41.6	91.7	25	70.5	7	21.2	1.54	Fair.
Oct	74	90	(*)	77.8	91.7	24	70.3	29	21.4	9.10	Average seasons, sharp shock of earthquake, 1:40 a. m., 27th.
Nov	36	68	(*)	63.1	89.9	8	66.9	29	23.	3.95	Fair.
Dec	23	61	(*)	71.1	89.3	14	63.9	24	25.4	0.23	Fair, slight shock of earthquake, 6:45 a. m., 17th.
Means	39	63	SE.	78.4	91.5	-------	67.7	-------	23.8	28.86	

* Variable.

Magnetic declination (or variation of the compass).

	Year.	Variation.	Direction.
		° ′	
Kingston	1891	2 16	East of true north.
Kempshot	1889	3 11	Do.
Do	1891	3 11	Do.
Lucea	1891	2 52	Do.

THE CLIMATE OF THE SANTA CRUZ MOUNTAINS, JAMAICA, WEST INDIES.

By JAMES HENRY CLARK, M. R. C. P.

The Santa Cruz Mountains have an elevation of 2,500 feet. The geological formation is chiefly white limestone, with a thick coating of red ferruginous earth. The climate can not be surpassed for its salutary influence on bronchitis, inflammation of the lungs, pleurisy, and rheumatism. The average maximum temperature equals 75.3°, average minimum temperature equals 66.8°, average mean temperature equals 71.1°. The rainfall is 38.25 inches; rainy days, 91. The climate is opposed to the generation as well as the evolution of tubercle in the lungs. Europeans who do not bring the germs of the disease seldom become phthisical. Those who do bring not only a predisposition but actually crude tubercle in greater or less quantity in the lung are often cured, or in the worst cases the progress of the disease is extremely slow. I am acquainted with a gentleman whose mother suffered from phthisis and died. He spat

blood on two occasions before leaving England, in 1844; he is still living, and attributes this to climate and care. One year I had on my visiting list seven Europeans and two natives, whose ages added together amounted to 751. Yellow fever is unknown, and typhoid has only occurred in two cases during the last twenty years. The roads are excellent. A post and telegraph office is accessible from 7 a. m. to 5 p. m., daily. Three churches are opened on Sundays. There is a first-class school for boys, the head master of which is a Cambridge master of arts (classical honors). There is also a school for girls. It will thus be seen that unusual educational advantages are to be found in addition to climate. The scenery is grand and the beauties of nature abound on every side. There is a large market twice a week where the delicious fruits of this country can be procured, with good beef, mutton, poultry, and fish. A sanitarium is wanted, with a resident physician, a farm, and livery stables, before patients in any numbers can be sent here. This matter is now engaging attention. I shall be glad to supply any information wanted at any and all times.

THE THREE CLIMATES OF JAMAICA, BRITISH WEST INDIES; ITS COAST OR TROPICAL, TEMPERATE, AND MOUNTAIN CLIMATES; JAMAICA REGARDED AS A WINTER ISLAND FOR HEALTH.

By Dr. WOLFRED NELSON, of New York.

In this brief sketch of the three climates of Jamaica I shall follow the division laid down by the Spanish discoverers, not forgetting that although Jamaica is English now, the country was Spanish once. All who have lived or traveled in Spanish America or the West Indies will recall the old-time division of climates into, first, the *tierra caliente*, a coast, or tropical, climate; second, the *tierra templada*, or temperate climate, and, third, the *tierra fria*, or climate of the lofty mountains. Several of us have lived and practiced in the tropics, and I do not see where we moderns can improve on the old division. As in the case of all truths, improvement is impossible. M. Paul Biolley, in a recent work, refers to the three climates as three vertical zones. He calls the coast country "the hot lands," their mean annual temperature varying from 72° to 82°. The central or second region he styles "the temperate lands," since they have a mild, healthful climate, with a temperature varying from 57° to 68°; and his third zone he calls "the cold lands," including the lofty mountains, or all the land above 7,500 feet elevation, where the difference between the temperature by day and by night is great, making a climate, of course, wholly unfitted for invalids. So much may be said by way of introducing the Spanish past and the English present and future of the beautiful "Isle of Streams." We must assume that our patients are of the well-to-do classes of the coast and inland cities of America, on or near the Atlantic Seaboard, the people who are ordered off by city practitioners to avoid the long and trying winter of the north. Medical men to-day are deemed little less than walking encyclopedias. Patients must be told to take summer and winter clothing; they must be informed which are the best steamer lines, and they must be furnished with a letter of introduction to some physician in the winter resort. In speaking of Jamaica I am not dealing with the unknown. From Panama and from New York I have sent patients thither, and the excellent results in selected cases have been alike gratifying to me and satisfactory to the health seekers.

A brief glimpse of the trip from New York City may be apropos. The Atlas Line lands passengers in about five and a half days at Kingston, the capital of Jamaica. Kingston has one of the finest harbors in the West Indies. There the patient is in the coast or tropical climate; the *tierra caliente* of the Spaniards, or

the "hot lands" of M. Biolley. When he has gone ashore, a hotel or pension will be in order. Both exist. The means of the patient will determine his selection. Kingston, thanks to its far-seeing mayor, Dr. Ogilvie, is one of the best-kept and cleanest of West Indian cities. I speak after experience gained in extended travel in the islands of the various groups. The weather and climate are the things next to be considered. The mornings are cool. It is hot at noon. Soon after midday a delightful sea breeze sweeps in from the Atlantic, a life-giving breeze, Dame Nature's own champagne. The evenings are pleasant and the nights are cool enough for restful sleep. Kindly bear in mind that I am dealing with the period recommended to the health seeker, from November to April, or the months so trying in these latitudes to all in impaired health. I assume, as a matter of course, that no seeker for health will visit any health resort, be it where it may, unless under medical advice. Many without skilled advice simply hasten the end, and rush off to die amid strangers. What are our patients to do in Kingston? Mental recreation they must have while the climatic cure is in order. Kingston has an estimated population of 60,000 people. There are four ably-edited daily papers furnished by cable with the news of the world. Public buildings, churches, and all that we moderns deem so essential to our artistic existence are to be found within the city. Lovers of nature will find her delightful pages open and ready for interpretation at every turn in any of Jamaica's three climates. Those of a scientific turn of mind and lovers of books can both satisfy their respective longings; all can easily find the mental distraction requisite while mind and body are obtaining needed rest.

Those who are to make a stay in the city will naturally like a change occasionally. What shall it be? Delightful and instructive trips may be made around the coasts of Jamaica by steamer, a journey of some 500 miles, the voyager visiting more than twenty ports and enjoying a succession of tropical vistas. Carriage tours may be made on the coast levels. Jamaica is famous for her perfect roads. To those from the north all will be new and highly attractive. A stay at the Constant Springs Hotel, some 800 feet above sea level, will be a pleasant change. The hotel is situated on a fine plateau some 6 miles out of Kingston, beyond the village of Hay-Way Tree. It is a large building, especially made for winter visitors, and substantially built of stone. It has the all-around galleries that are so comfortable and pleasant, offering a magnificent view as well as restful shade. There one can sit and feast his eyes on the varied tropical scenery made possible by the three climates of Jamaica. Below is the city of Kingston; beyond it stands old-time Fort Augusta, a Spanish souvenir. Close at hand are the foothills; above them Newcastle, a mountain camp, nearly 3,000 feet above sea level, and towering over all are the lofty Blue Mountains, whose peaks rise for 7,000 and 8,000 feet above the sea. Many delightful outings may be devised for pastime, such as picnics to the hills or trips to the city or to the Government Gardens. In the cool of the morning exercise may be taken on foot. With horses and carriages there will be no lack of variety. At the Constant Springs Hotel the guests are in a land of sunshine, with an average temperature of say 80°. Leaving there, let us go into Kingston and take the railway to the mountains, going there by carriage to the hotel at Moneague, built and opened in 1891 as a "hill resort;" a locale, in a climatic sense, midway between the coast and the mountain level at Mandeville (of which more anon). I found the hotel there good, suited to its purpose, with rooms well ventilated. The building has lower and upper balconies, delightful lounging places where the weary can rest body and mind and be content. The drive from the hotel to the railway, when it is taken early in the morning, is a wonderful experience. In the early hours the peaks pierce the masses of fleecy clouds that hide the scenery below. Looking down from the upper levels of the "divide," a Canadian will fancy the cloud masses to be a huge snow-covered plain. I have

made two trips to Jamaica. Limitations of time prevented me from visiting Mandeville. For my information regarding it I am indebted to the Hon. George Solomon, with whom Mandeville and the Santa Cruz Mountains are favorite themes. Mandeville is a mountain village some 2,000 feet above the sea level and just within Jamaica's second, or temperate, climate. On a clear day the view from Mandeville is wonderfully fine. The distant ocean can be seen, a vast sheet of blue, closed in by the horizon. Mandeville is within easy reach of Kingston, part of the way by rail and the remaining 6 miles by carriage. There are a number of boarding houses and a hotel. Arrangements for Mandeville should be made in advance. Jamaica represents a wealth of tropical scenery. Its variety gives it a special charm. Many patients require so much distraction that a suitable climate alone is not sufficient for them. Many of the nervous class must think of other matters and be forced into exercise and recreation. Exercise without fatigue should be the order. To the medical mind such exercise means much: tissue change, rest, repair, new strength, increased appetite, sounder sleep, and a greater capacity for enjoyment. Such a course in neurasthenia generally means cure, or what Dr. Linn in his book terms the "climatic cure." I have referred to two of the three climates of Jamaica. Those who are sufficiently well can investigate the third and "do" the lofty mountains. A day may come when sanitaria will be found in them, but for the purposes of our patients we must be content with two climates, leaving the third for convalescents and tourists.

M. Stern, M. R. C. S., England, L. R. C. P., London, in an excellent article on the climate of Jamaica,[1] refers to the seasons of the island as "two rainy and two dry seasons, one in May and one in October, lasting for about two months, the intervening periods being known as the dry season. From December to the end of April the weather is fine and dry." He adds:

In estimating the fitness of this or that climate, where it becomes a question of choice of residence for an invalid, barometric pressure and amount of moisture are also important factors in the calculation. The more equable the temperature, the lighter the air, the less the barometric pressure (always, of course, with certain limits), the clearer the sky, the more favorable are the climatic influences.

Dr. Stern quotes Dr. Lincoln, an American writer, thus:

It is now admitted that the most general test of the value of a climate consists in its suitability to be lived in, or, if this seems like tautology, the best climate is that in which a delicate person can be out of doors with comfort and safety for the greatest number of hours and days in the month. This requirement can be fulfilled in most cases only by the combinations of clear sky (sunlight), warmth (not of the rays of the sun but of the lower level of atmosphere), and equability or freedom from violent changes of temperature and chilling winds.

To quote further from Dr. Stern's extended experience as a practitioner in Jamaica:

Now, here, sunlight is abundant, equability is unquestioned, and in the higher lands there is the element of stimulus (which is, perhaps, somewhat wanting at the lower levels). Air stimulus is important in association with equability. The moisture, besides not being excessive, has this advantage, that it interposes a protective screen from the intense solar rays. Thus, sunstroke, so common an occurrence in New York, is, even in the hottest and most sultry day of exceptionally severe seasons, almost unknown. Exposure to the midday sun is, nevertheless, always to be avoided, especially by newcomers.

Dr. Stern rightly classes the climate as a sedative one, and while noting that such a climate may not be the best for all pulmonary cases, he adds:

For the catarrhal variety (of consumption) so common in England and America, such a climate is eminently beneficent, and we believe it will be found that it is mostly this form which has so wonderfully improved here. The genial warmth, the free ventilation, the light, the freedom from close rooms, the little chances of

[1] Handbook of Jamaica, 1881.

getting chilled, all contribute to this end. Perhaps we might venture to say that for all cases of incipient phthisis it is all that could be wished, arrest of the progressive symptoms being most marked.

Dr. Stern then passes on to review the springs of Jamaica, the curative waters of which are historic:

There are several mineral springs on the island. The two principal are, one in Vere, 50 miles from Kingston, the other in the pretty village of Bath in St. Thomas. The waters of the first are useful in gout and rheumatism. In this respect they will rival most if not all of the famed thermal waters of the Continent or even Buxton in Derbyshire, which we believe to be even more beneficial than Aix les Bains in Savoy, Baden Baden, or Wiesbaden.

The results of analyses of the waters in Jamaica have been published recently in a book issued by the Government of the island. The title of the book is, "Jamaica at the Columbian Exposition." The article referred to describes the springs, the climate, etc., and is from the pen of Dr. Thomas L. Stedman, of New York City. It appears also in Buck's Reference Handbook of the Medical Sciences. On page 84 of the book first mentioned Dr. Stedman mentions the following springs: (1) Milk River Bath, (2) St. Thomas the Apostle, (3) Jamaica Spa, (4) Silver Hill Spring, (5) Manatee Bay Spring. The first of these is a thermal sulphur spring, the second chalybeate, and the third a thermal saline spring.

Dr. William Osler, in his book,[1] describing a suitable climate, fully indorses the views held and advanced by Dr. Stern in 1881. Dr. Osler epitomizes the matter thus:

The requirements of a suitable climate are a pure atmosphere, an equable temperature, not subject to rapid variations and a maximum amount of sunshine. Given these three factors, it makes little difference where a patient goes, so long as he lives an outdoor life.

Dr. T. M. Coan, of New York, in his introduction to Dr. Linn's work, The Health Resorts of Europe,[2] summarizes the subject in happy phrase, as follows:

The very pleasurableness of health resorts, in fact, conspires with the scientific methods of therapeutics. The happy mind and the healthy body are correlatives. Watering places combine in a measure heretofore unknown the strictly curative arts with the means and appliances which go to make up cheerful daily existence. Whether in the beauty of the mountain solitudes or the stir of a crowded and sociable resort the philosophy of cure is the same, to combine the most approved methods of science with agreeable social and spiritual conditions. Under such conditions the tour and the cure are coincident.

In closing I can only reiterate a statement of my own, made some months ago:

Jamaica's greatest wealth is her perfect winter climate. A visit will reveal her grand and classic scenery, and her climatic advantages as a winter island for health are of the highest order.

LES MESURES PROPHYLACTIQUES CONTRE LES ÉPIDÉMIES

Par le Dr. J. B. DA LACERDA de Rio de Janeiro, Brésil.

Voilà un sujet, qui, je le sais bien, va attirer beaucoup l'attention du Congrès. Le Brésil et les États-Unis sont si rapprochés maintenant par une communauté d'intérêts économiques et sociales, que ces deux grandes républiques américaines ont le devoir d'accorder des mesures sérieuses dans le but de se défendre contre l'importation de certaines maladies pestilentielles.

À mon point de vue, la question est assez difficile et complexe: elle exige une longue discussion et beaucoup de réflexion. Au milieu des opinions diverses, soutenues par les représentants de tous les pays de l'Amérique, envoyés au Congrès,

[1] Practice of Medicine, New York, 1892. [2] New York, August, 1893.

il sera sûrement difficile, dans un délai très court marqué aux réunions, d'arriver à des conclusions précises, tout-à-fait pratiques, concernant les mesures prophylactiques contre l'importation du choléra et de la fièvre jaune.

Malgré tout, nous sommes encore aujourd'hui en faveur des quarantaines. Seulement il faut bien s'entendre sur l'application pratique de cette mesure, aussi bien que sur les détails. Ceux-ci ont une importance assez considérable, et c'est parce qu'ils ont été souvent méprisés que les quarantaines ont été accusées d'inutiles.

Au Brésil où la fièvre jaune s'est fixée depuis longtemps, nous n'avons qu'à nous défendre contre le choléra.

Eh bien; grâce aux mesures de défense bien prises et rigoureusement exécutées ici par une autorité sanitaire énergique et consciente de leurs devoirs, nous avons eu, il y a huit ans, le bonheur d'échapper aux ravages du choléra.

Du sein du Congrès Pan-Américain on pourrait bien faire sortir les bases d'une convention sanitaire, dont les prescriptions fussent respectées par toutes les nations de l'Amérique.

Ce serait, à mon avis, un des plus grands services qu'on aurait le droit d'attendre d'une si remarquable assemblée de médecins éminents.

BASES GENERALES QUE PODRÍAN PROPONERSE Á LOS DIVERSOS GOBIERNOS DEL CONTINENTE AMERICANO, PARA HACER UNIFORME Y EFICAZ LA POLICÍA SANITARIA MARÍTIMA INTERNACIONAL.

Por el Dr. EDUARDO LICÉAGA,

Presidente del Consejo Superior de Salubridad del Distrito Federal de México.

El continente americano bañado en toda su longitud por los dos oceanos, tiene que comunicarse con las otras partes del mundo por la vía marítima. Si por ella reciben millares de pobladores todos los productos de la industria y de las artes que han llegado á un alto grado de perfección en el Viejo Mundo, también ha recibido ya las enfermedades que transportan los hombres y las mercancías ó los gérmenes que las originan y que de tiempo en tiempo han sembrado en los pueblos del nuevo continente el luto, la desolación y la ruina.

El sentimiento de la conservación obligó á cada una de las naciones americanas á rechazar las epidemias; inspirados unos pueblos en el terror y otros en la experiencia adquirida en los del antiguo continente, ó cerraron sus puertas á procedencias de los lugares infectados, ó impusieron prolongadas cuarentenas y severas restricciones á los buques que procedían de aquellos.

Para la adopción de estas medidas, no sé yo que haya habido más acuerdo especial que la convención de Lima del año de 1888 y el Congreso Panamericano de 1889. Pero los incesantes progresos de la ciencia nos imponen la obligación de proponer nuevas bases para los convenios futuros y nunca se ha presentado ocasión más propicia para estudiarlos, que la presente en que se reune un congreso formado por los representantes de las naciones del continente americano interesadas en la resolución de esas cuestiones.

El acuerdo sobre este punto es enteramente necesario para atender á los intereses de la salubridad y del comercio: cuando no se ha llegado á él, como en el año pasado, que el cólera amenazó invadir el continente, Nueva York estableció una cuarentena de veinte días, Panamá la extendió á un mes y alguna de las Repúblicas sudamericanas hasta seis semanas, en tanto que México había reducido la suya á cinco días. De esta desigualdad, resultó que los buques se retiraron de los puertos en donde se les esperaba larga demora ó transportaban sus pasajeros y mercancías

tal vez infectadas, á otros buques que venían de puertos indemnes y que amparados por su patente limpia, podian llevar el contagio á naciones, que como la nuestra, habían disminuido el rigor de sus restricciones en beneficio del comercio.

El modo de proteger el continente americano, es que cada una de las naciones que le componen, en obediencia de sus propios intereses, procure la defensa de su territorio.

Un conocimiente más exacto de la duración que ordinariamente tiene el período de incubación del cólera, permite reducir á cinco días la observación de las personas que se sospeche puedan llevar el germen de la enfermedad; esta observación ha permitido confirmar, una vez más, que las deyecciones de los enfermos y las ropas y objetos que han mancillado, son los propagadores de la enfermedad, pero que no lo son las ropas limpias, ni la correspondencia escrita, ni los periódicos, ni los libros, ni las mercancías que no se hayan contaminado. La experiencia ha confirmado que el agua es un vector de los gérmenes de la epidemia. Estos datos de la experiencia permiten proporcionar á sus verdaderos fines el aislamiente de los enfermos, la desinfección de los objetos contaminados y la purificación del agua, poderosos recursos con que cuenta la ciencia sanitaria actual para impedir la introducción de una enfermedad transmisible ó detener su desarrollo.

El aislamiento de los enfermos ha de ser completo á fin de que este sea un medio eficaz de impedir la transmisión de la enfermedad. La desinfección, para llenar este mismo fin, ha de destruir los gérmenes que se encuentren en los objetos mancillados por las deyecciones de los enfermos. Estos son los principios; la manera de aplicarlos es variable.

Así por ejemplo, una nación realizará el aislamiento en un lazareto modelo, la otra en un hospital que ha apropiado á este uso, la de más allá en barracas provisionales y alguna habrá que establezca en un pontón su hospital de coléricos; pero todas harán el aislamiento completo y lo prolongarán el tiempo necesario para que sea eficaz.

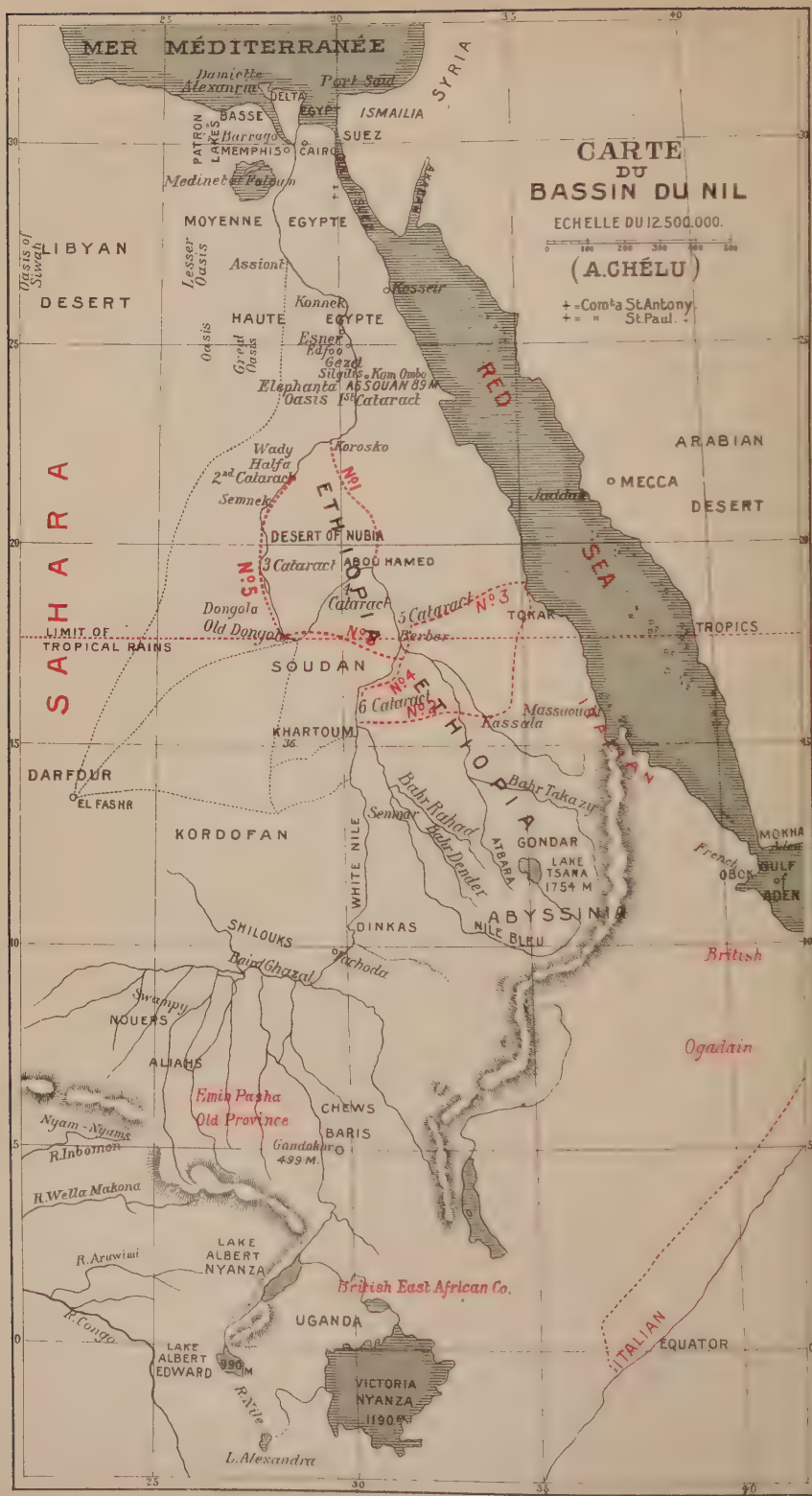
Perfeccionadas como lo están ahora las reglas para hacer la desinfección, bien definidos los objetos á los cuales se ha de aplicar, y muy reducido su número, podrán ser convenientemente utilizadas por todos los países de América. En unos se hará con la amplitud con que se hacen en Charleston y Nueva Orleans, en grandes instalaciones que pueden tomarse como modelo; otros, como México y la República Argentina, lo harán por medio de estufas de menores dimensiones, en las que se utilizan, para la destrucción de los gérmenes, á la vez el calor y la presión; en algunos se emplearán las cámaras en donde se produce el ácido sulfuroso por la combustión del azufre, y otros emplearán los aparatos portátiles que pulverizan la solución de bicloruro de mercurio, para impregnar con ella los objetos infectados; pero todos inspirados en los mismos principios científicos y aplicándolos con las reglas que ha establecido la experimentación, llegarán al fin deseado—destruir los gérmenes que propagan las enfermedades.

Un personal instruido en las operaciones de desinfección y convencido de su eficacia y de la del aislamiento para evitar la importación de las enfermedades transmisibles, será el ejecutor de las disposiciones sanitarias. Conforme á las instituciones de cada nación, ese servicio dependerá del Gobierno General, como sucede en México y como comienza á verificarse en los Estados Unidos del Norte, ó dependerá de los Estados que forman una república, ó de los municipios.

Mas para obrar en armonía, no basta estar de acuerdo con los principios científicos y las reglas de su aplicación: se hace además necesario convenir de una manera general, en la clasificación que se haya de dar á los buques, según su estado sanitario y á las mercancías según se encuentren ó no mancilladas. Desearía entrar en los detalles de esta clasificación para exponeros las razones en que se funda su conveniencia y para demostraros sus ventajas, pero temiendo ocupar demasiado el precioso tiempo que destinais á tantos estudios de importancia, me

limito á pedir que las naciones americanas propusieran á sus gobiernos la aplicación de medidas precautorias contra el cólera, que son ya uniformes en el continente Europeo, merced á la sanción que han recibido de los Gobiernos las conclusiones aceptadas en la Convención de Dresde.

Las proposiciones que tengo la honra de someter á la deliberación del Congreso, son las siguientes: (1) Uniformar la duración de la cuarentena, proponiendo que sea de cinco á siete días después del último caso de cólera habido á bordo. (2) Señalar en el litoral de cada nación cuál ó cuales puertos se consideran apropiados para hacer el aislamiento de los enfermos. (3) Establecer en esos puertos, lazaretos, hospitales ó casas de asilo destinados al aislamiento. (4) Indicar en cada país y en cada puerto de su litoral, cuales son los procedimentos de desinfección que acepta y en que forma los aplicará, para que las demás naciones sepan si pueden contar con una perfecta desinfección en esos países. (5) Hacer la declaración de que existe uno ó más focos de epidemia en una nación, dándolo á conocer á las demás por medio de sus agentes diplomáticos ó consulares. (Los casos aislados no se consideran como focos de infección.) (6) Indicar en la declaración de qué manera comenzó la epidemia, la marcha que ha seguido, el número de casos comprobados clínicamente y el de defunciones, y por último, las medidas que se han tomado para impedir la extensión de la epidemia. (7) Declarar las medidas que un Estado va á adoptar respecto á las procedencias de un territorio contaminado. (Este es uno de los objetos capitales de la uniformidad en los procedimientos.) (8) Se debe entender por territorio contaminado, aquel en que existan focos de epidemia colérica y solo á él se referirán las medidas de precaución. Se considerará como sano aquel territorio que no tenga actualmente foco epidémico aún cuando haya existido, siempre que hayan trascurrido cinco días despúes del último fallecimiento de que se tenga constancia oficial y á condición de que se hayan ejecutado las medidas appropiadas de desinfeción. (9) Conforme á las Conferencias de Venecia y de Dresde, dividir los buques, según su estado sanitario, en tres clases, como sigue: Infectados, Sospechosos é Indemnes; considerando como infectado al buque que al llegar al puerto lleva enfermos á bordo ó los ha tenido en los últimos siete días de navegación; como sospechoso al que ha tenido casos de cólera en el momento de la partida ó durante la travesía, pero en el cual no se ha presentado ningún caso nuevo durante los últimos siete días de navegación; indemnes, aquellos que no han tenido detunciones por causa del cólera ó casos de la misma enfermedad al salir del puerto, durante la travesía ó á su llegada, aun cuando procedan de puerto infectado; pero siempre que la travesía haya sido de más de siete días. (10) Adoptar para el tratamiento de estas tres clases de buques las medidas aceptadas por la Convención firmada en Dresde el 15 de Abril del presente año. (11) Adoptar las cláusulas de ese mismo Convenio Internacional en lo que se refiere á las mercancías ú objetos susceptibles, bajo el punto de vista de su desinfección, de su tránsito por territorios sanos ó contaminados y de la prohibición de importarlos á los países que se trata de defender. (12) Las cartas, correspondencias, impresos, periódicos, papeles de negocios y libros no se someterán á ninguna restricción cuarentenaria ni á desinfección.



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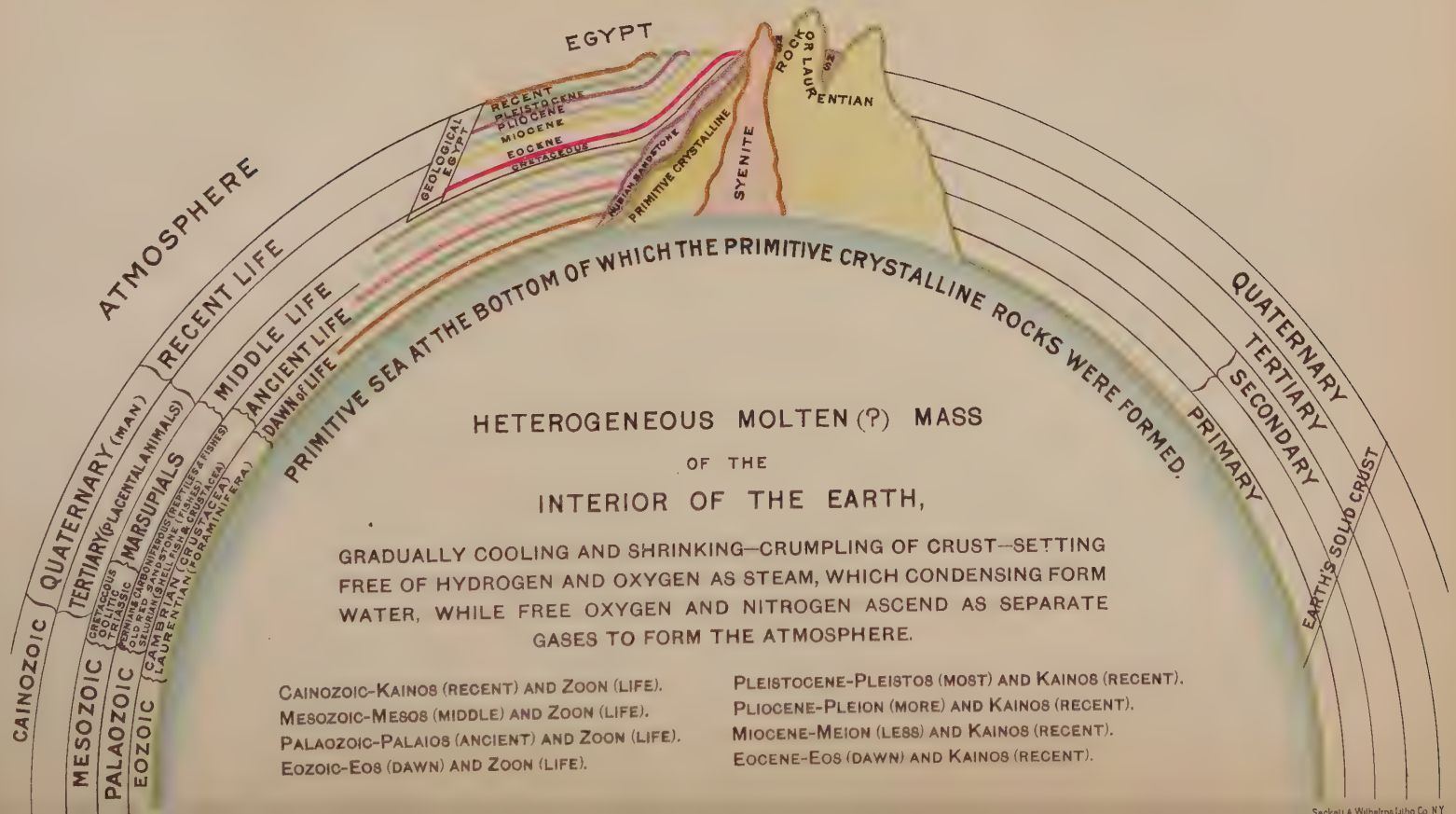
MERIDIONAL SECTION OF THE EARTH ON THE MERIDIAN OF ASSOUAN.



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ON THE CLIMATE OF EGYPT IN GEOLOGICAL, PREHISTORIC, AND ANCIENT HISTORIC TIME.

By J. A. S. GRANT (BEY), A. M., M. D., LL. D., of Cairo, Egypt.

CLIMATE OF EGYPT IN GEOLOGICAL TIME.

In treating of the climate of Egypt in geological time very naturally you will expect me to take you back along the thread of geological history to that period when the nebulous mass of this globe (thrown off during the formation of the solar system) took on somewhat of a definite shape and had already laid the foundation of its present crust. It would seem that the primitive waters of ancient mythology and tradition, during the contraction of this shapeless, nebulous mass, formed a universal sea of water with a universal sea of steamy, vaporous atmosphere above it, which entirely obscured the sun, although it was much larger and nearer then than now. At this period darkness covered the face of the deep and the climate must have been very hot and very damp, but there was nothing as yet to make it malarious, for no vegetation could have existed at this period. As the cooling process continued the misty steam that filled the atmosphere would in time take on more of the nature of clouds suspended in the air, thus permitting the direct rays of the sun to penetrate here and there so as to light up the primitive waters that now enveloped the central mass of this globe. During the formation of these waters the excessive heat had caused to be dissolved in them many of the primitive elements of our earth, which, as the water cooled, were slowly deposited in crystalline form and made a solid bottom for this primitive and still comparatively hot and shallow sea. In the upper stratum of this deposit Sir William Dawson has discovered the fossil remains of a species of *Foraminifera*, showing that the climate had so far changed as to allow of the existence of at least a low type of animal and vegetable life. The origin of such life does not come within the scope of this paper, as we have only to deal with things as we find them and draw our inferences as to the kind of climate that would allow of their existence, modification, or extinction. As shrinkage went on, owing to the continuance of the cooling process, the rocky bed of the sea would become crumpled up here and there from the external pressure, causing the shell of the earth to fall in. Thus projections of crystalline rocks would appear above the surface of the water and form the first dry land as islands, or even continents, in this vast sea. Sir William Thompson says the past age of the sun can not have exceeded twenty million years. This reduces the whole geological time of this earth since the formation of the crystalline (Laurentian) rocks to a period of about six million years. No doubt at different places in the inside of the crust of the earth we should also find at this early epoch pressure from within caused by igneous action, forcing up the crystalline shell at some places and even bursting it at others, causing geysers, burning mountains, and granite formations.

The first appearance of Egypt, some six million years ago, was in the neighborhood of Assouan, where we have both the above geological formations peering through the Nubian sandstone, viz. the primitive crystalline rocks intersected by igneous formations or granite. These rocks, now exposed, were being continually washed by a hot, shallow sea, while they were acted on at the same time by drenching rains, thus causing their slow disintegration, the débris of which settled at the bottom of the sea and formed the geological stratum known in our day as the Nubian sandstone. After a period of geological time the Egyptian part of the crust of the earth was still more upheaved, exposing a larger surface above water and laying bare a great deal of the Nubian sandstone that had been deposited at the bottom of the sea. The climate was still damp and very hot. All through the rest of the primary formations, and extending to nearly the end of the

secondary geological period, Egypt lost in area instead of gaining, for the more than tropical rains continued to disintegrate the rocks and washed the greater part of the Nubian sandstone into a sea, which was becoming more and more animated by animals that were rising in the scale of existence, and which was depositing, layer upon layer, at its bottom an illustrated history of its inhabitants and its work. Toward the end of the secondary geological period Egypt, Arabia, and Palestine appear as three rocky islands with fringing belts of sand. At this time the eastern part of the island that represented Egypt became submerged, and on it, at the bottom of a still very warm sea, a Cretaceous deposit took place, inclosing in its substance the remains of animals of a much higher type of organization than we have yet met with. Some of these animals were amphibious, so that they could come out of the water and bask in the sun on the sandy shore of the sea. They are all representatives of animals of a warm climate. The Tertiary period was ushered in by a general, though unequal, submergence of all that is known of the Egypt of the present day, except the region about Assouan, which continued to appear as a rocky island in the Tertiary sea just as it had done in the primary and secondary seas. During the deposit of the lowest stratum, called "Eocene" (nummulitic), of the Tertiary geological formation the geographical position of Egypt was still occupied by a comparatively warm sea, as shown by the fossils[1] that are now found in what must have been its bed. In due time the crust of the earth was pushed up out of the water by volcanic action[2] and became dry land. After a space of geological time alluvium was formed on the now exposed Eocene stratum and vast forests grew[3] that must have been well watered in the ordinary way by the rains of heaven. Naturally there would be a watershed somewhere, and therefore a river. This condition of things must have lasted many thousands of years, when another volcanic disturbance or natural shrinkage took place and a portion of this part of the globe became again the sea bottom. The alluvium was all washed away, leaving only sand and fallen, decaying trees, water-logged in a silicious sea, which was rendered all the more silicious by the presence in it of geysers. As the sea cooled down the trees became silicified, and lay like rocks embedded in the sand[4] at the bottom of the sea, while in the immediate vicinity of the geysers themselves the loose sand became solidified into a heterogeneous mass, containing many of the silicified trees in the lowest part of its structure. Some of the trees are palms,[5] showing that Egypt continued to have a tropical climate similar to that of the Soudan of our time. This new stratum formed what is called the Miocene,[6] and when it in turn was upheaved[7] and

[1] One of these fossils was presented by me to the late Prof. Sir Richard Owen, who described it fully in the Quarterly Journal of the Geological Society for February 7, 1875. It proved to be the fossil brain of an Eocene Sirenian mammal, of the same type as the dugong which still exists in the Red Sea.

[2] There is abundant evidence of volcanic action in various parts of Egypt. Near Cairo, at the cataracts, and along the Red Sea coast Plutonic rocks are met with.

[3] These forests contained exogenous and endogenous trees. Several species of the exogenous ones have been classified, and a species of the endogenous tree has also been discovered. It has been described by the late Sir Richard Owen as being "undoubtedly palm," but it has not yet been further classified.

[4] The sand was formed ultimately from the crystalline rocks of the interior and proximately from the waste of the Nubian sandstone and the sandy upper Eocene beds. The thickness of the Miocene sandstone stratum would be about 100 feet. (Dawson.)

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[6] The sand was formed ultimately from the crystalline rocks of the interior and proximately from the waste of the Nubian sandstone and the sandy upper Eocene beds. The thickness of the Miocene sandstone stratum would be about 100 feet. (Dawson.)

[7] The igneous rocks at Aboo Zabel, about 11 miles north of Cairo, belong to this period, or perhaps even a little later. (Dawson.)

became dry land all its loose sand was gradually blown away, leaving the Eocene towering up at places to the height of 600 feet, as the Mokattam range at Cairo, while the petrified trees were exposed lying on the surface of the Eocene. Of course where the sand itself was glued together by silica it remained as sandstone hills, such as "Gebel Ahmar" near Cairo, where traces of two geysers may still be seen and petrified wood embedded in its lower stratum, thus showing, as if it were written on the pages of a book, the exact position in geological history to which the petrified trees belong and the climatic conditions of that period when these natural forests existed. The areas of marine Miocene, however, in Egypt are rare, indicating that this region had already assumed in a great measure a continental character.

According to Sir William Dawson, at the close of the Eocene period the Gulf of Akabah, which had been up till then in communication with the Mediterranean, was closed, but the Gulf of Suez continued to be a strait, and the Mediterranean, which washed the base of the Mokattam range, extended even to the east of Gebel Attaka on the Red Sea. This remained so all through the Miocene period, so that there was free communication between the Red Sea and Mediterranean, and the disconnection could scarcely have taken place till the first continental period of the Pliocene, when the Blue Nile lost itself in a lagoon of the isthmus on the Red Sea side and contributed considerably to the enlargement of that isthmus. This was the first separation of the waters of the Red Sea and Mediterranean in geological history. The climate was then a little warmer than now, as may be gathered from the shells and animal remains of the Pliocene formation. The Pliocene age was probably more continental than the Miocene period. After this came the great Pleistocene submergence (about twenty thousand years ago), when the Red Sea and Mediterranean again intermixed freely for a short geological period, while the present valley of the Nile (without any Nile) was a long fiord of the sea stretching as far inland as the rocky barrier at Assouan and being gradually deepened by the erosive action of the sea. The raised beaches[1] near Cairo belong to this period, and the scattering of bowlders from the eastern crystalline mountains over the Libyan Desert seems to imply the action of floating ice[2] in some part of the Pleistocene period. The softer parts of the Miocene sandstone must also have been wasted away at this time. This was succeeded not long after by a reëlevation, partially restoring the conditions of the first continental period and finally connecting Asia and Africa by a permanent isthmus. A divergence is now manifested between the fauna[3] of the Mediterranean and Red Sea, the fauna of the Mediterranean taking the type of the Atlantic and that of the Red Sea the type of the Indian Ocean, showing a complete change between the climates of these two regions. The oldest part of the isthmus is the Miocene bed at Shaloof, about 13 miles from Suez and only 6 to 9 feet above the level of the Red Sea. This bed is covered in part by the old Blue Nile deposit of the Pliocene, or, as some geologists contend, of the later Pleistocene, both these having the continental periods, with an abundant rainfall. The highest parts of the isthmus are at El Gisr to the north and at Serapeum to the south of Lake Timsah. These elevated portions of the isthmus are composed of the old Nile deposits. Thus the ancient Blue Nile built up a considerable portion of the isthmus at a time when the climate was warmer than at present, for this limestony stratum, extending from El Gisr to Shaloof and stretching east and west, contains fresh-water shells that are now confined to the

[1] At Het el-Qorab hill, a little to the south of the Great Pyramid and at an elevation of 40 feet above the plain, there is an old sea beach of the Pleistocene period.

[2] Sir William Dawson inclines, however, to the water rather than the ice agency. In fact, there is no trace in the geological history of Egypt of there ever having been the cool summers necessary for the formation and continuance of a glacial period.

[3] At the present day the shell fish of the Red Sea are quite distinct from those of the Mediterranean.

Upper Nile and that have somewhat of a modern character as compared with what we might expect in a Pliocene bed. In the later Pleistocene it would appear that the Blue Nile and Jordan debouched into the same lagoon of the isthmus, which at that time of continental elevation was much more extensive than now. It is to this period that we must ascribe the Sahara Sea and the large inland sea[1] of Geikie which included the Black Sea and Caspian and a large tract of country to the west of the Ural Mountains. As long as these large bodies of water existed the rainfall in Egypt and Arabia must have been excessive, and this accounts for the manner in which the surfaces of the anorthosite gneiss or diorite and schist show such an amount of wasting and disintegration. Prof. Hull has also found evidences of a chain of ancient lakes in the Sinaitic Peninsula that must date from this period, and that disappeared when these inland seas dried up and the rainfall ceased. At the close of the Pleistocene elevation, or, in other words, in the early modern geological epoch, we find the Red Sea shells at the Bitter Lakes quite like the recent shells. The ridge at Shaloof must have been at this time under water, as we may judge by the shells now to be seen in its upper layer. Its elevation,[2] therefore, is quite modern, geologically speaking, and the elevating process continues, though slowly as measured by the geological clock. At a date more immediately preceding the prehistoric[3] period the land of Egypt was higher than at present, but owing to the earth's shrinkage the whole country sank considerably, thereby causing two fractures that are evident, one along the Mokattam range from Cairo to Suez and the other along the present valley of the Nile, whereby a depression of upward of 150 feet on the Libyan side took place. This convulsion of nature was so extensive as to divert the White Nile from being a confluent of the Congo and the Blue Nile from flowing into the Red Sea; and it caused these two rivers to unite to form the present Nile and flow down its present bed to debouch in a shallow gulf of the Mediterranean Sea, which had already retired from Assouan to a little above Memphis. Even at the present day, were the Nile to dry up, the sea would again reach this ancient limit (Memphis) along the empty bed of the river.

CLIMATE OF EGYPT IN PREHISTORIC TIME.

The prehistoric period of Egypt was ushered in by the formation of the present Nile and the fluviatile deposits that have made the country rich and habitable. This took place only about 8,000 or 9,000 years ago.[4] The Nile, however, did not find its way to the Mediterranean without encountering formidable obstacles in the shape of crystalline rocks, granite and sandstone dikes, and calcareous beds, which one by one were either swept before it at once or else the pent up water formed large lake districts and overflowed the obstacles as cataracts. Most of these have become gradually rubbed down[5] and form now only rapids. Some of them, however, were broken through suddenly, causing a regular deluge in the lower country; and several of these floods must have taken place in historic times, for when Solon visited Egypt, about 600 B. C., and asked the Egyptian priests if they had in their history any mention of the universal flood, such as is

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[1] It must have been during the existence of this sea that it was possible for the Mammoth to live in Siberia, as such a large sea must have modified the climate in its vicinity and thus made Siberia more habitable than it is to-day.

[2] In Strabo's time, 24 B. C., the Red Sea extended to the north end of the Bitter Lakes, and that only by means of a canal, originally dug by Darius Hystaspis (520 B. C.) from south end of Bitter Lakes to Red Sea, about 10 miles in length.

[3] Prehistoric as far as Egypt is concerned.

[4] The depth of the Nile deposit across the delta in the latitude of Zagazig was ascertained, by means of a series of borings, in 1883, to be between 30 and 40 feet; and as authorities are agreed that the rate of deposit is between 4½ and 5 inches in a century we thus find that the convulsion of nature referred to in the text must have taken place about the time stated.

[5] In the whole of the Nile valley from Edfore northward the geological formation is calcareous (Eocene), which the Nile has scooped out to the depth of 200 feet.

recorded in the Greek history,[1] they replied that they had records of several floods, no doubt referring to the sudden giving way of cataract barricades. The first obstacle to yield to the ever-conquering water in the prehistoric period was the sandstone dike at Silsilis, a few miles (40) to the north of Assouan. At this time the ancient Ethiopia, commencing at Assouan, was, in a great measure, under water, as the cataracts at Assouan and Semneh (near Wady Halfa) had not yet been worn down, nor had they given way. The same, no doubt, may be said of many of the other cataracts that simply made the Nile valley a series of lakes, while at the same time there was a large inland sea where the Sahara is now. These vast sheets of water, under a tropical sun, must have made the neighboring countries quite rainy, and amply account for the abundant evidences we have that the Nile at this time had a larger volume of water than it has now, and was fed by local rains and streams that rushed into it like so many Niagaras. (Petrie's Ten Years Digging in Egypt.) Prof. Sayce tells us (Ancient Empires in the East) that the wadys and cliffs on each side of the Nile valley are water worn and covered with bowlders and pebbles which bear witness to the former existence of mountain torrents and a considerable rainfall; and the discovery of Palæolithic implements near the little petrified forests and in other places makes it clear that some of the geographical and climatic changes the country has undergone have taken place since it was first inhabited by man.

THE CLIMATE OF EGYPT IN ANCIENT HISTORIC TIME.

As we advance to the historic period which has been characterized by the deposition of much fluviatile sediment, especially in the Delta, and probably by a slight depression[2] of the Mediterranean coast, accompanied by a slight elevation from the latitude of El Gisr southward, we find that the primitive prehistoric immigrant tribes that had come from a northern region and had settled as independent colonies all along the valley of the Nile were in time subjugated by another and a stronger race[3] coming from the east, or land of Poun-t.[4] It is only now that we find anything like a concentrated government and the establishment of a monarchy. The first historic dynasty began about 4800 B. C., and Manetho gives the name of the first king as Mena, the word itself meaning the establisher. The name may have been given to him in recognition of the power and ability he displayed in bringing all these different colonies under the rule of a central government. The exploits of Mena, as recorded by Manetho, throw considerable light on the physical condition and climate of Egypt at this early date, and clearly

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[1] The Flood of Deucalion and Pyrrha.

[2] All areas of great deposition tend to be areas of subsidence; hence the highland of El Gisr has in modern geological time been the axis on which the Isthmus has revolved, the south side rising and the north side sinking.

[3] These two races had not yet amalgamated at the beginning of the Fourth Dynasty (4034 B. C.), as in the tombs of this period Prof. Dr. Flinders Petrie noticed that the bodies of those he judged were the subservient race were desiccated in a doubled-up form like the ancient Inca Indians, lying with their heads to the north and their faces to the east, while those he judged were the ruling race were buried full length. The skeletons of these two primitive divergent human types are now being studied at the museum of the Royal College of Surgeons, London, and before long we may hope to have more light thrown on the subject.

[4] "Poun," according to Brugsch, means "east," but according to others it means "red." The name was applied in later times to the southern part of Arabia and the Somali country, and no doubt, as the ancient Egyptian tradition was that their forefathers came in this way to settle in Egypt, Arabia was always referred to in the hieroglyphic text as the Ta-Nuter (the Holy Land). For there is no doubt now that Mena and his followers brought with them a purer worship of the sun than they found among the primitive dark skinned colonies, who, besides the sun, that all of them revered, had each a distinctive totem of its own. At a later period in man's history another race followed in the footsteps of Mena, passed through Arabia and crossed the Red Sea, and after lingering in Egypt for some time ultimately concentrated their government on the northern coast of Syria and at Carthage. They were called Pounians, Phounians, or, as we have it now, Phœnicians.

show that in order to carry out great sanitary measures that are to benefit a whole country the central government must take the thing in hand and employ experts. The cataract at Silsilis had either broken through or had become gradually worn away, thus liberating the large body of water which had been impounded above it, and so diminishing the rainfall in the vicinity. Before this water was liberated a large amount of alluvium was deposited for probably 1,000 to 1,400 years, and it may be mentioned as an interesting fact that these large tracts of land, then left high and dry, now only await the magic touch of irrigation to become highly productive. The cataract (granite) at Assouan was still high (100 feet higher than now), and a branch of the river swept round by the present ancient quarries and reëntered the main channel a little to the north of Assouan, making Assouan an island. The cataract at Semneh was also intact, making Ethiopia an extensive lake district. Many of the other cataracts, however, had given way and were now only rapids. Notwithstanding the emptying of many of these inland lakes, and consequent destruction of vegetation, the rainfall must still have been considerable in those regions that are now rainless. Mena, with his followers, seems to have entered the valley of the Nile by way of Arabia and the Red Sea. His first seat of government was at This or Abydos, situated between Assiout and Luxor. At this time, even as now, Abydos was on the border of an extensive fertile plain that required no great skill for its irrigation. Mena no doubt visited Silsilis, and could see at a glance how much was to be gained even by a partial restoration of the cataract there; but for some reason or other he did not attempt it, although he had no mean engineers in those days, they having already built the Temple of the Sphinx and hewn the Sphinx itself in the native rock at Gizeh (Maspero). No! Mena's exploits were carried out in the northern Egypt of that day. In the region between Heliopolis and the Temple of the Sphinx he saw a battle going on among the watery elements, the sea and the river striving for the mastery. The river was throwing its mud in the teeth of the sea, and wherever there was a sand island there the mud was thrown up and rank vegetation soon appeared. The sea, little by little, had to retire, leaving swampy morasses behind it, where the crocodile and hippopotamus were at home, but making the whole of this region malarious and unhealthy to man. Mena set himself to remedy this state of affairs. He was the grand sanitarian of those early days. He caused a great dike to be raised about 30 miles to the south of Cairo and directed the channel of the river into the center of the valley, as it was then flowing by the foot of the Mokattam range on the east side of the valley. This he followed up by raising other dikes as he required, so as to get the control of the river and drain off the marshes. This was evidently the beginning of reclaiming the delta from being a morass; which would no doubt change the climate considerably and make it much less malarious. On part of this reclaimed land Memphis was built, which continued to be a city of some considerable importance down to mediæval times. While Mena was directing his irrigation schemes he was attacked by a hippopotamus and killed, after a reign of sixty-two years. The presence of the hippopotamus would indicate a warm climate, but not necessarily much different from what we have now, for Dr. Abd-el-Lateef, writing at the beginning of the thirteenth century of our era, has recounted that hippopotami were very common in the Damietta branch of the Nile at that time, and even so late as Mohammed Aly's time[1] (1811 to 1848) a hippopotamus was killed near Mansoura in the delta.

[1] Within my own memory there was a rendezvous of crocodiles at Gebel-Abu-Fadah, about 200 miles to the south of Cairo. I saw a whole family of them in 1867. They have since been exterminated by travelers. And as crocodiles and hippopotami live in the same climate the disappearance of these animals from Lower Egypt has not occurred from any change of climate, but from the presence of hostile man. The same may be said with respect to the lion, which used to be hunted by the Pharaohs in the vicinity of the pyramids of Gizeh, and by the Emperor Hadrian near Alexandria. This animal has now retired to the Soudan and equatorial regions.

No doubt the good example set by King Mena was followed by his successors, so that the river was guided in its course and land was reclaimed whenever possible. By the time of the fourth dynasty (4034 B. C.) Bubastis, near Zagazig, was founded and inhabited. The vast proportion of the present delta, however, was still a gulf of the sea, with the muddy Nile running into it and gradually forming the delta. By the sixth dynasty (3500 B. C.) some of the sand islands in the gulf had become inhabitable through the pioneers reclaiming the morass around them. On one of these islands Tanis or Zoan was founded, which played an important part in the history of Egypt in later dynasties. When we reach the twelfth dynasty (2500 B. C.), Amenemhat III, the sixth king of that dynasty, took great interest in reclaiming the swamps and in the proper watering of the land already reclaimed. He is celebrated for having conferred great benefits on his country by the construction of dikes and reservoirs for controlling the water supply.[1] He caused a nilometer to be chiseled on the rocks at Semneh, a few miles south of Wady Halfa, and in connection with it a series of hieroglyphic inscriptions, recording the rise of the Nile during his reign; from which we learn that the waters of the inundation rose on one occasion 27 feet, and on an average 11½ feet, above the greatest rise of the Nile at the present day. At that time, therefore, the cataract at Semneh had not yet broken down, and Ethiopia must therefore have been a well-watered country. The rock inscriptions also show that the Nile below Semneh rose some 10 feet above the highest Nile of our day, proving that the cataract at Assouan was only being slowly rubbed down; the island of Philæ being of course then under water.[2] The climate of Upper Egypt would still be somewhat rainy, although by this time the Sahara inland sea would be very much contracted from what it used to be. The great dam at Silsilis had broken through its barrier in prehistoric time and apparently no attempt had been made to restore it, unless perhaps on paper, as has been done in more modern times. This Pharaoh (viz, Amenemhat III) has rendered himself immortal by having created an inland fresh-water sea in a natural depression in the Libyan desert not far from the Nile and quite near Memphis. Suffice it to say here that water was conveyed to it from the Nile by means of a canal (the Bahr Yousif of our day), and when the basin was filled it was said to be 450 miles in circumference and at parts 350 feet deep. It was called by the Greeks Lake Mœris,[3] but in the hieroglyphic language it was called Ta-She—the lake country. It continued to act as a reservoir for the Nile surplus of water, and to irrigate the country around till the Roman period, when the dikes were neglected, the sluices fell out of repair, and the water thus ran to waste; so that in the time of Pliny (70 A. D.) it was already dry, with the exception of what still remains under the name of Birket-el-Qoroon, or Lake of the Horns, so named from the form of the lake being like the shape of a pair of horns.

[1] It may be incidentally mentioned here, although it has no direct bearing on the climate of Egpyt, that under this Pharaoh the embalming of bodies (which in itself is a great sanitary measure) was more carefully done, as is proved by an examination of the mummies, from this period downward; and besides, the sacredness of the Nile was more insisted on, so that the Egyptians of those days had a purer water supply than the Egyptians of to-day.

[2] It was in connection with the twelfth dynasty that Prof. Flinders Petrie found in Upper Egypt traces of an Ionian colony of workmen that had been employed by one of the Usertesens. At a very early date there were direct commercial relations between Egypt and India, and indirect through Mesopotamia, so that Egypt was often exposed, then as now, to the importation of Indian and Mesopotamian communicable diseases; and notwithstanding the extraordinary attention given to sanitary science by the ancient Egyptians we find from history that every now and again fatal plagues among men and beasts that were not indigenous to the soil devastated the country, showing that the climate was favorable to the propagation of such diseases, and that the country itself was not more sanitary than it ought to have been.

[3] The Greeks, who never acquired any intelligent knowledge of the ancient Egyptian language, would often hear the natives call this lake "Meri," which simply means "lake," and they evidently concluded that it was the name of the Pharaoh who had created it, hence the erroneous appellation—Lake Mœris—has been handed down through the Greek historians.

Very naturally this depression in the desert, after having been constantly filled with the muddy Nile water and partially emptied for irrigation purposes year after year for a period of nearly 2,400 years is, now that it is dry, one of the richest provinces of Egypt. Its present name, "Faioum," is simply the Coptic name "phiom" or "the sea," carrying us back to the time when, instead of the 231,283 acres of rich arable and cultivated land of to-day, this was a veritable sea. This large body of water must have modified considerably the climatic conditions in its neighborhood; for we must not forget that where we have fresh water to deal with in a warm climate we have always an abundance of trees[1] and vegetation that materially and sensibly affect the temperature and rainfall. The Faioum now is a malarious district, but more especially in the vicinity of Lake Qoroon,[2] which is brackish; and the rainfall is almost *nil* throughout the whole of this region. Amenemhat III died about 2266 B. C., and was succeeded by a number of kings of little account as far as this paper is concerned. Still, about 2200 B. C., the fourth Pharaoh of the thirteenth dynasty made a record on the nilometer at Semneh, showing that the cataract there was still holding out; yet, under the sixth Pharaoh of this dynasty, monuments were erected on the island of Argo considerably to the south of Semneh, but below the level of the formerly dammed backwaters of the cataract. Some time, therefore, between these two reigns, a period of only sixty-six years, the Semneh Cataract must have rather suddenly given way and caused a destructive flood from all along the course of the Nile to the sea, and famine[3] would have been the natural result of such a sudden catastrophe. Ethiopia was now left high and dry, and became more or less a barren waste, even as it is to-day. It is with great labor that the natives now raise the water from the Nile to irrigate their little patches of ground, simply to grow sufficient to keep them alive, and I fear that famine is not uncommon among them. Here, then, another rainless district has been produced and it remains so. We may now say that the whole stretch of country from Assiout to Berber, which had an abundant rainfall in ancient times, is now almost without rain. No doubt this would be reversed if the cataracts were restored, a new Lake Mœris created at the border of the ancient one, the Sahara[4] refilled with sea water, and the Eurasian Sea restored, for under these circumstances the rainfall would again be excessive. As far as the restoration of the cataract and Lake Mœris is concerned, this has been studied by the Egyptian Government[5] for several years past, and the study is still being pushed forward by American,[6] French,[7] and English[8] engineers. When we go up the Nile as far as Berber, 17½ north latitude, we enter the region of the tropical rains that, following the course of the sun, and falling in torrents

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[1] The ancient Egyptians were much more fond of arboriculture than the modern Egyptians. The sculptures tell us that Ramses III, twentieth dynasty, about 1280 B. C., "over the whole land of Egypt planted trees and shrubs to give the inhabitants rest under their cool shade."

[2] Lake Qoroon is now about 35 miles long and 7 miles broad, and is on an average 28 feet deep. It rises and falls with the Nile, although it is always many feet below the level of the Mediterranean.

[3] A very interesting hieroglyphic inscription on one of the rocks near Assouan records a famine of seven years under an early Pharaoh. Another 7-year famine is recorded as having commenced in 1064 A. D.

[4] M. de Lesseps projected a scheme for letting the Mediterranean into the Sahara depression, by cutting a wide canal to the south of Tunis, commencing in the Gulf of Gabes.

[5] *Vide* 4.

[6] W. Cope Whitehouse, an American engineer, has for years been very enthusiastic over a new Lake Mœris nest or depression he thinks he has discovered in the Faioum district, which would act admirably as a reservoir for the surplus water at high Nile and be a source of water supply at low Nile.

[7] M. de la Motte, a French physician, has been for years advocating the restoration of the Silsilis Cataract.

[8] The English engineers of the Egyptian Government have proposed to construct a dam at the first cataract, but to the south of the island of Philæ, so as to save that island from submergence.

on the Abyssinian mountains, and in the equatorial regions, create the Blue and White Nile, which, uniting at Khartoum, form the river that makes Egypt a habitable country. These rains are periodical and produce the annual rise of the Nile, to which we in Egypt are so accustomed that we often forget that a few feet above the annual rise or a few feet below the average fall means famine and disease. The usual difference between high and low Nile may be taken as 40 feet at Assouan, 25 feet at Cairo, and only 4 feet at Eamietta and Rosetta; but in ancient times, with a greater rainfall and a fuller river, these figures would have to be nearly doubled. We have seen that reclaiming the delta was a very gradual process; and even at the present time the Government is draining the swamps and lakes to make the districts around them more healthy, as well as to have the land available for cultivation; and such reclamation must proceed so long as the Nile continues to bring down such large deposits of alluvium from Abyssinia and Central Africa. Formerly the delta swamps formed an inaccessible hiding place for culprits, refugee kings, and their followers; and they were also the home of the plague, pestilence, and other serious forms of disease recorded in history, or at least favored their propagation when imported. The rainfall in the delta for 30 miles inland is now as much as 10 to 12 inches annually, influenced in some measure, no doubt, by the large salt marshes and lakes lying across the 160 miles of Mediterranean front, viz, Mareotis, near Alexandria, covering 250,000 acres; Edko, 100,000 acres; Burlos, 300,000 acres; Aboukir, 50,000 acres; Menzaleh, 500,000 acres, and Sirbonis, near Palestine, 100,000 acres. Most of the lakes did not exist in comparatively ancient times, but the districts now covered by them were richly cultivated and supported a numerous population.

Lake Menzaleh was formerly a district celebrated for its fertility, but in 535 A. D. the sea broke through and submerged the eastern portion, and by 540 A. D. the whole of this region was totally under water. All the towns on the low levels were destroyed by submergence and only those that were built on high ground escaped, but they became so malarious and unhealthy that after a time they were deserted and even the country around that was not submerged became swampy, unhealthy, and ruined for agricultural purposes, just as it is to-day, so that the population in this region has always remained scanty.

The present Lake Mareotis was originally a small sweet-water lake surrounded by a famous vine-growing district, celebrated in ancient times for its fertility and salubrity; but in 1801 A. D. the sea was intentionally let in for military purposes, and this entirely destroyed the whole district and converted it into a malarious environment of Alexandria, which otherwise would be a much healthier city than it has been ever since this regrettable event. About the beginning of the Christian era Lake Sirbonis was 125 miles in circumference, and more anciently was much larger, and is said to have engulfed a whole wing of the army of Ochus, King of Persia. It is now an insignificant lake, having little or no perceptible effect on the climate in its neighborhood.

Lake Abookeer has recently been drained and is now being cultivated. This will do away with the malarious swamps in its vicinity and render this part of the country once more healthy.

I can not close this paper without saying something about the influence of the condition of the Isthmus of Suez on the climate of Lower Egypt. In even late geological time we have seen that Africa was an island, so that the Isthmus of Suez is of recent formation. While "the tongue" of the Red Sea still came as far north as El Gisr, it increased the rainfall in Lower Egypt and modified the climate in its vicinity considerably. When it dried up, naturally the rainfall depending on it ceased. This is proved by the fact that since the refilling of the Bitter Lakes and opening of the Suez Maritime Canal, in 1869, we are having a

greater rainfall again in Lower Egypt, aided, no doubt, by a more extensive irrigation and planting of trees, which the Government is wisely encouraging. This, however, brings me to speak of the climate of modern Egypt, which I have discussed elsewhere.[1]

THE CARE OF THE PUBLIC HEALTH A NATIONAL DUTY.

A NATIONAL BUREAU OF HEALTH.

By P. B. ARMSTRONG.

The United States Government everywhere typifies all that is good and thoughtful for the welfare of the masses. Yet, strange to say, it has made little or no determined effort looking to the preservation of the public health, the protection of its citizens from the ravages of disease, or the prolongation of the lives of its people. Good health is so universally sought, is such an absolute necessity to material and financial success, that its possession should be labored for before everything else. There is no man who has accumulated wealth and lost health who would not gladly exchange the former for the latter. In 1879 a National Board of Health was established, and for a time was quite active. In 1882 Congress stopped appropriations for its support, and it vanished. It is believed that the abandonment of such a wise project was due to the influence of men who held executive positions in State quarantine or other public health bodies. We suggest the establishment of a national bureau of health on the broadest basis, and conducted, under the control of the Government, by expert sanitarians, believing that it would accomplish more during the first fifteen years of its existence toward the suppression or the modification of disease than has been accomplished in the whole history of man. We realize that its establishment would constitute a vast undertaking, and to perfect it would not be the work of a day or a year. What we seek is to absolutely banish all contagious and infectious diseases, and until that can be done to modify their virulency.

The diseases which carry off the vast majority of the human race are those which can be very greatly restricted in severity and volume or completely exterminated. Among the deadly list are tuberculosis, pneumonia, diphtheria, smallpox, measles, scarlet fever and typhus fever, cholera, and yellow fever. If these most virulent forms of disease can be controlled is it not reasonable to assume that all diseases of a contagious or infectious character can be? An eminent physician says: "They may be largely limited, or almost wholly blotted out, by intelligence and care." Antidotes have been found for every class of poison, and specific remedies are now administered for quite every form of disease. This leads us to believe that by a concert of action on the part of the National Government with the great life insurance companies methods for prevention or for the modification of the severity thereof can be provided for all contagious and infectious diseases which will prove as effectual as inoculation for smallpox and hydrophobia. Upon page 12 of the Transactions of the Seventh International Congress of Hygiene and Demography, held at London (England) August 10 to 17, 1891, we find the following brief inquiry made by one of its learned members: "Why, if diseases are preventable, are they not prevented?" The answer to this was:

That while an instructed minority may understand the importance of observing hygienic laws, a very large section of the community is careless of and indifferent to their observance, and consequently the portions of those laws which are individual and personal in their application are left a dead letter. Acts of Parliament are of little avail so long as the people they are framed to guide do not real-

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[1] At the Medico-Climatological Congress, Chicago, in connection with the auxiliary congresses of the World's Fair.

ize their value or importance, and it is quite certain that the only way to stamp out preventable disease is to educate every member of the community to feel the importance of the laws of health.

The discovery of the principle of inoculation as evolved by Jenner and Pasteur, the many discoveries in remedial agents, and the use of antiseptics in surgery show not only what has been already accomplished for the prolongation of human life, but what is likely to be accomplished in every branch of medical and surgical science in the future. We learn, very recently, that Dr. Haffkine has inoculated over 200 persons at Simla, India, for cholera, including many medical men, high officials and ladies. Several native Indian States have taken up his system of inoculation, and it is used at Agra, Delphi, and Lucknow. In one British regiment over 400 men have been inoculated. How successful this experiment may prove is yet matter for conjecture, but it is in line with the theory which we advance as to the eventual discovery of means for the prevention of all forms of disease.

Sanitary science as a humane study is of comparatively recent date. In the history of medicine it has been a question of treatment of disease rather than its prevention. Improved surroundings, a thorough education in sanitary matters, and training of the public mind will be necessary before our people will accept and adopt the required measures in full. Even in England, where within the last thirty years not only the medical profession, but the laity, clergy, and business men, have given some attention to the matter, the work is but in progress, and sanitary arrangements are still far from satisfactory. In the United States, where, by virtue of our form of government, each village, town, city and State, exercises a much greater degree of self-government, that unity of action necessary to the maintaining of the public health can hardly be expected without a thorough education of its citizens. Strange as it may appear, and greatly to their honor, it can truthfully be stated that about the only practical work, from a sanitary standpoint, accomplished in the United States has been by physicians, the stability of whose profession depends upon the occurrence of disease. The great life insurance companies of this country, which have to-day nearly $12,000,000,000 of insurance in force, covering over 10,000,000 of lives, certainly have a primary interest in the prolongation of human life, and yet they have done absolutely nothing toward encouraging this great reform.

Dr. MacDonald, of Canada; Dr. T. Mitchell Prudden, of New York, and others have written of the possibility of controlling disease, but so far as we have been able to ascertain, the only materialized plan for its accomplishment has been recently suggested through the New York Academy of Medicine and is embodied in a draft of a proposed bill to establish a bureau of public health, which it intends to submit to the next session of Congress. Their proposition as now before us contains one vital defect; it would make the bureau an adjunct of and subservient to the Treasury Department, instead of a department standing as clearly alone as the Treasury Department itself. Unless stringent measures are used in establishing this bureau, it will become a part of the political machine of the party in power, thus destroying in a large measure its usefulness. The proposition of the Academy of Medicine requires the members of the bureau to attend to this duty only upon occasion, and pay them a *per diem*. This would not attain the end in view. How much more rapid would be the advance of science in suppressing or preventing disease should such bureau devote its whole time, knowledge, and influence to that one subject? The question of saving a few dollars should not enter into so important an undertaking. The object should be to prevent disease and to prolong life, regardless of cost. The first steps taken by the National Government should be the passage of stringent laws regulating the health of immigrants, the sanitary condition of goods imported, and the sanitary condition of

every city, town, and village throughout the country. Do away with noxious surroundings, polluted atmosphere, and impure water; prohibit the sale of articles of food deleterious to public health, and a great and important preliminary work will have been accomplished. What can be accomplished toward the prevention of disease will be better understood when it is known what has been done with one disease in one State. A conservative comparison and estimate shows that in the State of Michigan alone, during the three years, 1886–'88, at least 10,000 cases of diphtheria were probably prevented and more than 1,700 lives saved by intelligent isolation and disinfection. If that was accomplished in one State in three years, with but local industry and power, think what might be done in the entire Union if the mighty arm of the Government, controlled by the highest medical and scientific skill, was directed toward the extirpation of disease.

The medical associations of the United States at the present time have no power to compel the adoption of valuable sanitary suggestions, as their recommendations are viewed with jealousy and are uniformly regarded as gratuitous by the health authorities, whose appointments are habitually made on the ground of political service or political preferment. Such bodies as are now working in the interests of the public health should become a part of the proposed organization, as also the Surgeons-General of the Army, Navy, and Marine-Hospital Service. By the establishment of such a bureau sanitary science would be advanced by the practical application of sanitary laws, by educating and preparing sanitary men throughout the entire country, and by the appointment of scientific men instead of, as now, men of no particular training in their specialty.

Our proposition for the remedy of this evil is substantially as follows: That the sanitary service throughout this country be divided into local, State, and national: that an arbitrary supervision over each department be exercised by the Federal Government; that all appointments shall be free from political vicissitudes; that the management of each branch shall be in the hands of paid officers, who shall gather and classify statistics and present measures to Congress in the interests of public health; that such officers shall be in correspondence with representatives of boards of health in every State in the Union; that the residence of the sanitary representatives shall be in the State of which each is a legal resident; that one or more laboratories shall be established in each State for the analysis of all material concerned in the production and propagation of disease, and for the discovery of the conditions favorable to its growth, and that the internal and coast quarantine shall be under the control of the national bureau. We further suggest that the education and care of children and an examination of the condition of children in schools, workshops, and elsewhere be carried out upon a fixed plan—a comprehensive and systematic inquiry into the causes of diphtheria, children's diseases, such as scarlet fever, whooping cough, etc.; the habits of children in school, and their cramped position at desk; their time and methods of open-air exercise during school hours; a careful and systematic inspection of all public and private schools; the instruction of girls and women in domestic hygiene as part of their education; special regulation for the control of block dwellings for the industrial classes; special examination and registration of architects; instruction, examination, and registration of plumbers; the cremation of such as die from infectious diseases; the compiling of statistics as regards sick insurance—the results to be classified as to sex, age, conjugal relationships, and occupation; the actual occupation, how long engaged in same, hours of work, previous occupation, and duration of illness; in diseases that terminate fatally, the predisposing cause, the duration of illness, and the cause of death, all with a view of destroying, if possible, the causes of sickness or delays in restoration to health. The difficulties in effecting such organization will be; first, from the opposition of those now in power, who, under the new organization, may be replaced in course of time by trained sanitarians; and

second, from the prejudice which exists in some States against the centralization of sanitary power. Let the public, however, become educated to the fact that all contagious diseases can be kept out of our cities and homes by the rigid observance of simple sanitary laws, as cholera has been kept out of New York for the past two years by quarantine, and any official who opposes the progress of a bureau of public sanitation will be immediately swept out of official life. No political party or politician dare suggest, at the present day, the withdrawal of the protection of quarantine or the abandonment of hospitals for the isolation of contagious diseases. Let the public once appreciate that these are but a few steps that the general or local government have taken toward the improvement of the health and physical condition of its citizens, and the demand will go up from all parts of the land that the General Government go forward in the line of its duty. Who are the proper parties to educate the public as to the duties of the Government, and their rights in this important matter? We believe a combined movement on the part of the great life insurance companies, assessment associations, and fraternal organizations, representing over 10,000,000 policy holders, headed by the officers of these companies and associations, could bring to bear upon Congress a power that would result in the prompt establishment of a national bureau of health, and thereby benefit mankind, prolong life, and give to our citizens the blessing of health which is above and beyond all other gifts or benefits that it is within the power of Government to confer upon its citizens.

MUNICIPAL SANITATION IN ST. LOUIS.

By GEORGE HOMAN, M. D., Health Commissioner.

The practical application of the principles of sanitation in a new or comparatively new country is, from the conditions presented, largely experimental, and therefore lacks the precision and completeness which may be seen in older communities having more settled characteristics and where the necessity for thoroughness in this respect is more fully recognized and understood. And this aspect of the question must of course be considered in rightly judging whether a given community has or has not lived up to its responsibilities in respect of sanitary work. In St. Louis the progress of municipal hygiene has been hampered in divers ways, and the full realization of the possibilities of preventive sanitation in the field there presented delayed through various adverse causes. The naturally good facilities for surface drainage existing there have exercised a beneficial influence on local health, and this advantage has been reënforced by artificial means to no small degree, so that the removal of rainfall, and the delivery by sewerage of the liquid waste of a large portion of the city into the Mississippi River goes on rapidly and efficiently. The public drainage system is placed in charge of a special branch of the city government, termed the sewer department, and the same is true of the public water service, and also the cleaning and maintenance of public streets and alleys; so that it is only secondarily that the health department figures in connection with questions having a sanitary bearing coming under the immediate jurisdiction of these several departments. Rapid growth in population and expansion of closely peopled territory beyond present attainable sewerage bounds have raised many difficult questions and offer knotty problems demanding prompt solution aside from the mere matter of drainage, although that of course is always one of prime sanitary interest and importance.

The plan upon which the health department of St. Louis was projected and created has many good features, and others not so good. Upon assuming charge of it about the end of last May I presented to the board of health, as the advisory

power therein, a plan of reörganization for sanitary work, the main features of which plan will presently appear. The sanitary division of the health department has immediate charge of the city's health, and is the direct agency by means of which complaints are investigated, inspections made, nuisances abated, offenders against sanitary law brought into court, etc. For the effective performance of this service the distribution of the work must be arranged for with reference to systematic coöperation by the entire force concerned in its accomplishment. In order to meet the foregoing requirement the force available for sanitary work was assigned as follows: (1) A corps of intelligent, active men was detailed for the duty of making sanitary inspections and house-to-house visitations, this force being divided into squads, each in charge of an experienced man and held responsible for the good condition of certain prescribed districts. (2) A corps of ditchers and drain layers for the abatement of pond nuisances on public property and other work of like kind. An important part of the work performed by this force is the laying of sanitary house drains in suburban localities that are beyond the reach of the regular system of sewers. (3) A house-posting and disinfecting corps for the work of public notification and suppression of communicable diseases. This branch of the division contains a number of physicians who come in contact with those members of the medical profession reporting cases of such diseases. The others attached to this force do the routine disinfection work. It is in present contemplation to reörganize this corps, uniting with it the public vaccination service, and constitute it a separate division under expert medical direction, equipped with all the latest approved means of attacking infection lodged in human habitations, fomites, etc. (4) A corps of men for the disinfection of public alleys, rear yards, and other offensive conditions by means of chemical solutions applied by sprinkling carts or other suitable means. This to be a temporary service only, intended for use in hot weather when putrefaction goes on most rapidly, and to be applied in closely built and thickly populated districts. (5) A corps of men for the inspection of meat, fish, poultry, and game in meat shops and butcher stalls, and the condemnation and seizure of all market supplies of this kind found to be of bad quality. Besides this duty they inspect slaughter-houses, yards, and pens where butchers' stock is kept, sausage factories, etc., coöperating with the men of the corps first mentioned, and doing such other work as may be assigned them. (6) A small corps of men appointed under the law authorizing the reduction of garbage by the Merz process, a company organized for that purpose having a ten-years contract with the city for the disposal of all garbage and dead animals delivered to them. The collection and removal from the streets and alleys of slops and garbage to be thus reduced is done under a separate contract with the health department, the latter, together with the police department, being charged with the duty of seeing that the terms of the contract for garbage removal are enforced. (7) The office of city chemist was revived with provision for competent assistance and ample laboratory facilities; and this addition to the working force of the department has proved of great value. While by law this branch of the department is placed directly under the supervision of the board of health, and not the health commissioner, still the sanitary division receives great assistance from it in its work, inasmuch as a part of the duty of the city chemist is to make analyses of all suspected food substances, water supplies, ice, etc., and as the number of surface wells in St. Louis is large, the condemnation of which must be preceded by chemical test, an extensive field for work is opened in this direction.

Another important service confided by me to this office is the work of photographing the various establishments and conditions complained of as nuisances, the parties responsible for which are summoned in due course before the board of health for a hearing on the question of condemnation. These concerns are of

various character, comprising bone-boiling and bone-drying places, fertilizer works, rendering establishments, candle factories, dairies, slaughter-houses, and many other kinds. In some of them large property interests are involved and, in addition to the oral testimony given at the hearing, the evidence afforded by the camera is a very valuable aid in obtaining a clear understanding of the situation and in reaching a just conclusion in the matter. And, further, when it is found necessary to carry cases into court the photographic evidence is still useful. This agency has been adopted as a permanent feature of sanitary work, and its application and development in this line has thus far abundantly proved its value. The health department has an auxiliary in the office of the dairy and milk inspector, the officials of which, however, are not subject to direction by the department, but coöperate in its work upon request.

The projected plan of work as herein outlined has been in successful operation all summer with the exception of the fourth corps, lack of time and money for its proper organization having prevented its being placed in the field. At the outset of the sanitary campaign thus undertaken the proper points of attack were ascertained by a pin-and-map method; that is, the records of the department showing reports received of dangerous diseases were consulted, reaching back for a year or more, and the location of all such cases were indicated on a city map by means of pins. Of course wherever the pins clustered most thickly a local disease center was indicated, where sanitary work was most urgently needed; and this method has been found to serve other department ends in a very effective way. The sanitary division in its preventive work is necessarily in close relation with that other division to which is assigned the duty of treating the indigent sick in their homes, securing their isolation, if need be, and, if necessary, removing them to hospital. In this work, when cases of communicable diseases are to be handled, the manner in which it can be done with a minimum amount of danger to the public has to be considered; also the speed of its accomplishment, consistent with the comfort and safety of the patient. To meet these requirements, and in view of the especially favorable conditions presented therefor in St. Louis, a system of electric railway ambulances has been projected and is now in course of accomplishment whereby the delivery of sick and injured persons, the dependent insane, and the indigent coming under the municipal charge may all be transported to their appropriate destination with a far greater degree of speed and comfort, and of safety both to themselves and the public, than by the horse ambulances which they will replace.

An important municipal step in the direction of increased public comfort and health was effected some years ago, when a general system of street sprinkling was begun, the cost of which is assessed against the abutting property; and this, following the general replacement by granite, asphalt, and wood-block pavements of the soft, broken limestone previously used as paving material, has most markedly abated the dust nuisance formerly so grievous when this work was done piecemeal and the street surface was easily pulverized.

There is no reason to doubt that a decided decrease in the number of cases of respiratory affections due to atmospheric causes, and alleviation of such troubles, has followed these two innovations. The city atmosphere is still impure in that it ordinarily contains palpable matter in suspension; this manifest impurity consisting of soot and smoke due to the imperfect combustion of the soft coal almost universally used. But energetic measures are now being taken to remove this drawback through the compulsory use of smoke-prevention devices, with very good prospect of ultimate success, and thus bring relief from that which is an evil in a cosmetic as well as sanitary sense. In close connection with the consideration of the purity of air must be ranged the question of the freedom of the public water supply from contamination by suspended or dissolved impurities; and the unsightly appearance of St. Louis water as commonly presented, due to admixture of mud and clay,

has tended no little to her discredit, even though the organic taint found in it be inconsiderable. But this reproach is also in course of removal through the construction and near completion of new pumping works and settling basins 7 miles above the present intake, the tax on the capacity of the present works being so constantly great as to not afford time for the sedimentation of the daily supply. The chief avenues by which disease may enter the human body are three in number; namely, the respiratory tract, the alimentary tract, and the cutaneous surface; and if the vehicles carrying the organisms of disease are searched and sterilized before entrance is gained the development of forms of communicable diseases within the body may not occur. This, of course, requires that the air shall be free from mechanical irritants and living pathogenic germs, so that no morbid process may be set up in the air passages and that ingested food and drink shall not contain the elements of bacterial infection. It also implies that no foe to health and life be introduced by cutaneous or mucous inoculation, for with all these portals securely guarded the citadel of the body is quite safe against attack. To assure this immunity to every inhabitant is the aim of all municipal sanitation, and St. Louis has made provision, it may be in all respects not fully systematized and complete as yet, to bring this within reach of her people, and with fair assurance of success.

The school of experience is sometimes the only one in which either cities or individuals can learn, and the price of tuition is often high, but the lessons thus learned are usually not forgotten. St. Louis has not been exempt from instructive lessons of this kind, and has profited wisely in the main by her mistakes, so that it may be said now that the cause of public health rests on a sure foundation and that progress is steady in the right direction. And while, perhaps, it may not be claimed that on her site the ideal city of health will rear its halls and towers, still her people, through vigilant, wise sanitation and advancing knowledge, will assuredly enjoy a freedom from all forms of preventable diseases equal to any, and superior to very many, of her sister municipalities of near or equal size.

CAUSAS Y MODO DE PROPAGACIÓN DE LA NEUMONÍA LOBAR AGUDA.

Por el Doctor DOMINGO AVAÑAMO, México.

La neumonía es la enfermedad que produce mayor mortalidad en la República Mexicana, después de las fiebres, pues pasa de la cifra de 100 por mil defunciones en varias localidades de la Mesa Central. La enfermedad ataca mayor número de distritos en la parte de la República comprendida entre los 17° y 24° de latitud. Invade particularmente la parte alta del país ó tierra fría, notándose sin embargo, que se presenta en muchos distritos de la tierra templada y en algunos de la tierra caliente, en particular en la costa del Golfo. La zona más invadida comienza en el norte de los Estados de San Luis y Zacatecas; sigue por todo el Estado de Jalisco y la parte occidental de Michoacán, en donde disminuye algo en el distrito de Tacámbaro; continúa en toda la parte oriental de todo el Estado de Michoacán, todo el Estado de Querétaro, exceptuando el distrito de San Pedro Tolimán, y sigue después exceptuando muy pocos distritos por todos los Estados de México, Hidalgo, Tlaxcala, Distrito Federal, la mayor parte del Estado de Morelos y casi toda la parte norte del Estado de Guerrero. Fuera de esta zona de mayor invasión hay otras varias pequeñas, diseminadas en toda la República, haciéndose notar muy particularmente la que ocupa toda la parte oriental del Estado de Campeche y una pequeña del de Yucatán.

Se puede decir de una manera general, que el número de casos de neumonía que se observa en las poblaciones está en razón directa de la altura; así es que las ciudades de Zacatecas y Toluca, de los Estados de Zacatecas y de México, respectivamente, y la pequeña población del Guarda en el de Morelos, cuyas poblaciones son de las más elevadas de la República, son aquellas también en que son más numerosos los casos de esa enfermedad.

El fin del invierno y principio de la primavera, es la época del año en que se observa más frecuentemente y con el carácter más grave. Las principales condiciones meteorológicas que nos han parecido coincidir con la exacerbación de la enfermedad, son la disminución de la presión atmosférica y de la humedad del aire, el aumento en la velocidad del viento y la mayor extensión de las oscilaciones diurnas de la temperatura.

Durante los meses de marzo y abril es común observar en varias poblaciones que algunos puntos son invadidos con mayor intensidad. Respecto de la ciudad de México, se ha notado que en aquellas habitaciones expuestas hacia el norte y en todas aquellas que se hallan á lo largo del canal de la Viga, que es el que conduce principalmente los desechos de la ciudad, es donde el número de casos es más frecuente. Por lo común hay varios casos á la vez, sucesivamente en cada habitación, y se ha notado varias veces por muchos médicos que ejercen en la ciudad, que las personas que están en contacto más inmediato con los enfermos son también las que con más frecuencia sufren después la invasión de la enfermedad. Pudiera citar muchos hechos recientes que confirman el contagio de la neumonía, pero esto alargaría demasiado este escrito, y por lo tanto solamente indicaré lo siguiente: Primero, que es común observar que varios indivíduos que habiten la misma casa sean atacados sucesivamente con diferencia de pocos días; segundo, que se han notado otras, que un individuo de fuera de la población que va á visitar á alguno de sus parientes atacado de neumonía, no es raro que contraiga la enfermedad y que regresando después á su población trasmita la enfermedad á las personas que habitan con él; tercero, que se ha observado algunas veces en los hospitales la presencia de numerosos casos de la enfermedad y esto de ordinario en la misma sala y no raras veces en enfermos que estaban más cercanos uno á otro; cuarto, que también se ha observado la invasión simultánea de la enfermedad en varios miembros que habitan la misma casa.

Todos estos hechos agregados á los que se han observado ya en otros países no hacen sino confirmar la creencia, casi general ahora, de la contagiosidad de la neumonía. Pero al mismo tiempo que confirman esta creencia nos indican la manera como la transmisión se verifica. Indican que lo mismo que el tifo, la neumonía se transmite por el contacto directo del enfermo ó de sus ropas y también por el aire, aunque á distancias muy cortas, de pocos metros. Otra clase de hechos se han observado también en la ciudad de México que parecen demostrar que los gérmenes que produce la enfermedad se conservan y propagan en las atargeas y albañales. Además del hecho señalado al principio de que la enfermedad es más común á la orilla del canal de la Viga, hay este otro hecho de observación, que al ir descubriendo las atargeas en diversas calles de la ciudad, con el objeto de hacerla limpia de ellas, lo que se verifica todavía, por desgracia, de una manera enteramente primitiva é inconveniente á pesar de las advertencias del consejo de sanidad, se va observando que la neumonía se desarolla en algunas calles del trayecto, al mismo tiempo que el tifo y algunas fiebres de forma intermitente.

En otros países se han observado hechos semejantes. Bauti atribuyó una epidemia de pulmonía que hubo en Florencia hace pocos años á los efluvios que se desprendían de los detritus del Arno, que se había desecado y á donde van á dar los desechos de los albañales de la ciudad. De la misma manera en Dublin, Grinshau y More han notado varias veces que la neumonía se desarolla en aquellos indiví-

duos cuyos alojamientos se hallan invadidos por las emanaciones de los albañales. El año 1882 en París se desarolló una epidemia de pulmonía en el hospital de la Salpêtrière después de la limpia y reparaciones que se hicieron en los albañales. Pero una de las epidemias que comprueba á nuestro juicio de una manera más evidente la influencia nociva de los gases de los albañales, es la que tuvo lugar en la pequeña ciudad de East Sheen el año 1874. En frente de la ventana de una escuela había una boca de albañal; la municipalidad mandó colocar un obturador, dispuesto de tal manera que se pudiese ventilar el albañal del exterior al interior, pero no al contrario; algunos días después, habiendo aumentado súbita y considerablemente la presión del aire del albañal después de una fuerte marea, se produjo una corriente en sentido inverso, saliendo los gases al exterior y proyectándose hacia la fachada de la escuela. En la tarde de ese día los criados del establecimiento, que tenían sus cuartos en el frente del edificio, no podían soportar el mal olor y al día siguiente uno de ellos fué atacado de pulmonía, después otros dos, y por último dos alumnos; todos estos enfermos tenían sus habitaciones con ventana á la calle. Se mandó clausurar la escuela, se tapó la abertura del albañal y ya no volvió á presentarse ningún caso nuevo. El año 1887 recuerdo haber sido llamado para asistir á unos enfermos en el número 9 de la calle de Venero en la ciudad de México; me encontré con cuatro enfermos graves, tres de neumonía y uno de una fiebre perniciosa perfectamente caracterizada que subió á 41° C. La única causa á la que se pudo referir estas enfermedades fué á la limpia de la atargea de la calle, la cual no se había limpiado hacía seis años; se hallaba azolvada, y al quitar las tapas que la cubrían, los gases fétidos contenidos allí inundaron la habitación de que se trata, produciendo una extraordinaria fetidez y originando desde luego dolor de cabeza, desvanecimientos y náuseas en todos los habitantes. Casi al mismo tiempo tuvo lugar la invasión de la enfermedad en los cuatro enfermos de que se ha hablado. La translación del de fiebre perniciosa á otro lugar impidió que se repitiera otro acceso, y respecto de los otros tres enfermos de pulmonía, sanaron dos y murió el otro, un niño de ocho meses.

He oido referir á algunos compañeros de la profesión de casos de neumonía y de tifo que han estallado á la vez en una misma habitación y cuya causa no podía ser otra que las emanaciones de los albañales. También he sabido de varios casos de niños en el período de lactancia que han sido invadidos ya de neumonía ó bien de tifo, estando sana la persona que los criaba lo mismo que las demás de la casa, no habiéndose puesto en contacto directo ni indirecto con algún enfermo, y no pudiéndose, por último, encontrar otra causa sino las emanaciones de los albañales. Estos últimos hechos que acabamos de referir demuestran la naturaleza infecciosa de la neumonía, así como los que referimos antes, demuestran su naturaleza contagiosa. Pero á los casos de contagio inmediato que se han citado en gran número desde hace ya tiempo, se han añadido hace poco otros casos de contagio mediato, perfectamente comprobados. La ropa de los enfermos, tanto interiores como de cama, han sido los principales agentes del contagio. Entre varios otros podré citar los dos siguientes, referidos por Flint:[1] Un hombre murió de neumonía el 9 de mayo de 1883; la hermana de este hombre, que vivía en una casa distante dos kilómetros, prestó el día del fallecimiento algunas sábanas y un cobertor de lana á su cuñada; un mes después mandó á traer estos objetos, de los que algunos habían servido para cubrir el cuerpo del difunto. Estas ropas, sin haber sido lavadas, fueron empleadas para el uso de la cama de un niño de cinco años. El 10 de junio este niño, que no había salido de la habitación ya hacía tres semanas, fué atacado de pulmonía. El hijo de un tapicero que llevó á su casa un sillón perteneciente á una persona que estaba en la convalescencia de la pulmonía, fué atacado por la enfermedad tres días después. Por último, una criada cuya

[1] La pneumonie lobaire aiguë, par le Dr. M. Boulay: Paris, Tome I.

ama estaba atacada de pulmonía fué á ver á su madre á una ciudad distante y durmió una noche en la casa. La madre de esta criada fué atacada de pulmonía.

Las habitaciones son también un vehículo frecuente de transmisión de la enfermedad; se ha visto, en algunas ocasiones, que cuando ocupa una familia una habitación en la que ha habido un enfermo de neumonía, alguno de sus miembros es invadido poco tiempo después por la misma enfermedad, y por lo común es la persona que ocupa la pieza en donde antes había estado el enfermo de neumonía. Varios autores han citado últimamente el hecho de la frecuencia de las pulmonías en algunas habitaciones. Schroeder[1] ha observado en una sola casa, en que los inquilinos se habían cambiado muchas ocasiones, 31 casos de neumonía de 1868 á 1882. Yo he visto en una habitación de los médicos del hospital de Jesús, de la ciudad de México, que han tenido lugar ocho casos de neumonía durante un período de diez años.

Esto parece demostrar la resistencia de los agentes que producen la enfermedad, á los medios ordinarios que originan la destrucción de la mayor parte de los microbios.

El neumococo, que tiene por vehículo los esputos de los neumónicos, se ha visto que puede resistir á una desecación de estos esputos, verificada hacía cuatro meses. La resistencia para el frío de este microorganismo también es notable, pues no muere, colocándosele en el hielo durante muchos días. La luz solar directa que produce la muerte del bacilo de la tubercolosis en pocos minutos, y la luz difusa que tiene el mismo efecto después de algunas horas, no produce el mismo resultado en el neumococo, sino después de un tiempo mucho mayor.

No sé que se haga uso todavía de las prácticas de la desinfección en ningún país tratándose de la neumonía. Por lo que toca á México no sé que hasta ahora se haya pensado en recurrir á dichos medios, pero el número de casos tan considerable de neumonía que se observa todos los años y la reflexión acerca de los hechos que he mencionado y de otros muchos que se pudieran citar, es seguro que han de obligar muy pronto á las autoridades sanitarias á colocar la neumonía entre las enfermedades que exigen las providencias dictadas para las otras afecciones sinóticas.

THE NEED OF RESEARCH IN PREVENTIVE MEDICINE.

By JAMES M. POSTTE, M. D., of Hinckley, Ala.

During the hours passed in meditation upon a subject for the Pan-American Medical Congress there was none which came so vividly to mind as the need of research in preventive medicine. We realize the pressing need of the subject in hand when we see our country threatened by the various epidemic diseases which come to our shores from foreign lands. Also the appeals of our people to the quarantine officials and board of health to stamp out any and all contagious diseases which rise within our borders. In the perspective of the past we see the clouds of superstition and ignorance gently rolling backward and giving way to the brilliant sunshine of advancing knowledge. We are nearing the point, and rapidly, where the old saying, "An ounce of prevention is worth a pound of cure," will be fully understood, even by the laity. It is not many years since the physicians began to inquire more deeply into the etiology of disease, and to the tireless efforts of the scientific investigator we are indebted for our present knowledge of bacteriology. Beginning with comparatively no knowledge upon the subject and with the simplest possible methods at hand they have evolved the present

[1] *Loc. cit.*

system of research, which is of so much importance to us as physicians and surgeons. And when we consider the valuable service rendered by Lister, Virchow, Billroth, Pasteur, and others, we are led to wonder how they have accomplished so much. Sanitary science and hygiene play a most important part in the subject under consideration, and of them it is only necessary to say that a careful perusal of the latest and best works will bring convincing proof.

After thirty years of patient investigation Jenner was able to give us the valuable knowledge that there was one disease which could be ameliorated, and in many cases complete immunity obtained therefrom, by the process of vaccination. If one, why not many? If many, why not the vast majority of diseases with which we are afflicted? With the single proof our conception carries us on until we are lost in contemplation of its possibilities. The identification by Nicolaier of the bacillus of tetanus or lock-jaw, and the absorption of its ptomaines, the elucidation of its preventive treatment by Kitasato, marks a most important point in our history. He has shown that by the introduction of iodoform within an hour or two after the production of a wound it will destroy the baccilli and prevent the formation of their ptomaines and the resulting absorption. Koch, by the recognition of the bacillus tuberculosis and the comma bacillus of cholera, or the spirillum, as we now know it to be, has conferred a lasting benefit upon mankind. As a result of his research we are taught to destroy all tuberculous sputum and to prevent the contamination of healthy individuals with those who have either of the diseases. The chemical discovery of tyrotoxicon and its clinical manifestations by our honored president of this section, Dr. V. C. Vaughn, with the sources of contamination; the discoveries in the etiology of erysipelas, anthrax, and many skin diseases; the valuable contribution of Dr. Roswell Park in regard to the bacillus coli communis, which was read before the American Surgical Association, June 1, 1893, and which is given to us in the last number of the Annals of Surgery; the great impetus given the study of surgical bacteriology by Drs. R. Park, of Buffalo, Nicholas Senn, of Chicago, and many other noted surgeons of the past and present; to those mentioned, and the countless number unnamed, humanity owes a debt of gratitude which it never can repay, and this Pan-American Medical Congress should return to them their sincere love, honor, and veneration.

With this reference to a few of the points which are leading us to the position of preventive medicine, it is not necessary to enumerate further, for the outcome is obvious. And there comes a further thought, combined with a desire to see America represented in the first ranks of medical science, and that is, that this congress petition our Government to establish on a permanent basis a laboratory in which to carry on bacteriological research, the investigators to be chosen from among the leading bacteriologists of the United States, and the position not to depend on political influence; that the results of the research, combined with that proven in other lands, be published in book form and distributed to the physicians of all lands who desire them at enough above cost to assist materially in maintaining the laboratory, our Government to assume control of all examinations to practice medicine in the United States and place us on a level with other nations. It is only by a careful study of sanitary science, hygiene, and bacteriology, as they develop, that we can hope to arrive at the goal, "positive preventive medicine," where we can say that it is "Not for ourselves alone" that we are laboring, but for all mankind.

SCHOOLS IN RELATION TO THE SPREAD OF DIPHTHERIA.

By PETER H. BRYCE, A. M., M. D., of Toronto, Canada,

Secretary of the Provincial Board of Health of Ontario, English Secretary of the Section, etc.

It is only the supreme importance of this subject that furnishes me with an excuse for drawing the attention of the members of this section to that which must seem to many, an old song. According to the returns of the registrar-general, almost exactly 25 per cent of the total population of England is between 0 and 10 years of age, in the proportion of 13.5 per cent between 0 to 5 years; 11.8 per cent between 5 to 10 years. Of the total school population in Ontario children between 5 and 10 years form almost 55 per cent; and I find that 31.6 per cent of the total deaths from diphtheria in Ontario occur within this period. These statistics further indicate the fact that the school population between these ages represents, at any rate in Ontario cities, nearly 18 per cent of the total population, and that the percentage of deaths of diphtheria amounts not only to more than 30 per cent of the total from this cause, but that it represents more than 2.3 per cent of the mortality from all causes in a city like Toronto. When it is further remembered that over 13 per cent of the total population is younger than 5 years, and that in almost every home whence come children of school age there are younger members at home, it will not be difficult for us to explain how it happens that nearly 90 per cent of the victims of diphtheria occur in about 25 per cent of the total population. These facts premised, and the statement of Bourges in the most recent book on diphtheria, "Il est aujourd'hui sans conteste que la cause unique de la diphthérie n'est autre que la bacille de Klebs-Löffler," it will be proper for us to examine some of the reasons for the special incidence of diphtheria among school children, especially of the age referred to, and why it is that this percentage of deaths to the whole is higher than it should be, if we remember that the deaths in 100 sick children between 0 and 5 years is 39 per cent, compared with that among those between 5 and 10, viz, 20 per cent, or much greater than the proportion of actual deaths in the first period, as compared with that in the latter. Among these reasons is the character of the bacillus. Observers have long noticed the tendency of diphtheria to develop in those houses in which organic decay was notably present, either as accumulated filth in cellars or having dark, damp, and ill-ventilated spaces under them, with decaying wood present. It has by experiment been further demonstrated that the germs will live a long time in unclean, dark, and ill-ventilated rooms, and on cloths, clothing, etc., when not exposed to fresh air and sunlight. On the other hand, it has been shown that in light, clean, and well-ventilated rooms the virus of diphtheria within a few weeks becomes largely inert or destroyed. The air likewise from sewers, whether from manholes or by defective plumbing, has, especially in the latter case, frequently been the cause of outbreaks of the disease. In all these ways diphtheria outbreaks have been produced; but the very conditions under which these outbreaks occur best illustrate how the living air of rooms, either from a patient or from the clothing of persons exposed in the sick room or other infected apartment, is daily being shown to be, of all agencies, the one which plays the most important rôle in spreading the disease. Ever since the statistics of deaths have been registered with care, as in England during the last fifty years, the incidence of what are called "communicable diseases," in the months extending from November to May, has been noticed; but it has not been until bacteriology has taught that the microbes of these various diseases can grow and multiply only in warm temperatures that the explanation of how house atmospheres, during the period of the year when ventilation is least and when children are kept indoors, have become the conditions under which infection has been most

frequent. This is due not only to the fact of the increased number of germs present in house atmospheres, but also to the fact that the conditions most favorable for producing a congested mucous membrane, thereby making inoculation possible, prevail especially in cold weather. Such are the immediate conditions favorable to the propagation and spread of diphtheria, as of other contagious diseases; but, stated broadly, the special condition is one of density of population. This, in the study of vital statistics, has formed the subject of extended inquiry by many writers. In the study of English statistics the late Dr. Farr was able to lay down a formula by which he was able from the known number of persons per acre or per square mile in any district to calculate the general death rate, which was found to conform very closely to the number of deaths from the mortality returns. Thus death rates calculated gave 18.90, 19.16, 20.87, 25.02, 28.08, 37.50, 38.74; registered gave 16.75, 19.16, 21.88, 24.90, 28.08, 32.49, 38.62. These studies were of course made where sewerage and water supply and other sanitary conditions were largely the same. The ill effects of increased aggregation of population have further been found to be much greater in the earlier years of life. Thus, from the thirty-fifth English annual report, persons to a square mile, 16.6, 379, 4,909, 65,823; death rate at all ages per 1,000, 16.94, 21.90, 28.02, 38.67; death rate under 5 years, 37.80, 47.53, 82.10, 139.52. The last figures in the list refer to the Liverpool district.

In a remarkable paper published in 1888 by Dr. J. B. Russell, medical health officer for Glasgow, this law has been illustrated and refined in a most remarkable manner by applying it to the relation between the size of the house and the general death rate. He compared the twenty-four districts into which Glasgow is divided and obtained the following results:

Size of house.	Percentage of population.	Deaths per 1,000.	Size of house.	Percentage of population.	Deaths per 1,000.
One room	24.7	27	Four rooms	6.1	4.3
Two rooms	44.7	47	Five rooms	7.1	3.3
Three rooms	16	13	Institutions	1.4	3.2

The one and two roomed houses were commonly what are known as "made-down" houses, i. e., parts of large houses divided into many rooms rented separately. He found further the following relative to deaths from special diseases per 1,000 of population:

	One and two roomed houses.	Three and four roomed houses.	Five rooms and upward.
Zymotic diseases	4.78	2.46	1.14
Acute diseases of lungs (including consumption)	9.85	6.89	3.28

These remarkable statistics, from the standpoint of causation, are further illustrated by the experiments of professors of Carnelley and Haldane, published in the Transactions of the Royal Philosophical Society:

	One-roomed houses.				Two-roomed houses.				Houses of four rooms and upward.			
	Cases.	Lowest.	Highest.	Average.	Cases.	Lowest.	Highest.	Average.	Cases.	Lowest.	Highest.	Average.
Persons per house (per room in last class)	29	2	10	6.6	13	4	10	6.8	18	1	3	1
Space per person	29	104	528	212	13	148	395	249	18	391	4,206	1,833
Temperature (°F.)	21	43	61	55	9	50	59	53.5	13	42	63	54.5
Carbonic acid	29	6.3	32.1	11.2	12	7.1	13.2	9.9	18	4.5	11.7	7.7
Organic matter	29	7.8	38.1	15.7	11	5	30.2	10.1	18	1.1	12	4.5
Total microörganisms	28	6	240	60	13	8	128	46	18	.5	22	9
Bacteria	19	6	120	58	11	6	118	43	16	.5	16	8.5
Molds	19	0.	5	1.2	11	0.	10	2.2	16	0.	1	.4

	Schools.							
	Naturally ventilated.				Mechanically ventilated.			
	Cases.	Lowest.	Highest.	Average.	Average.	Lowest.	Highest.	Cases.
Per cent of windows open				22	3			
Number present, including staff	39	27	191	92	64	20	170	20
Space per person	39	56	427	168	164	119	228	20
Temperature (°F.)	35	44	65	55.6	62	58	69	18
Carbonic acid	39	7.9	37.8	18.6	12.3	7	19.6	20
Organic matter	38	5	40.3	16.2	10.1	3.4	19	20
Total microörganisms	35	8	600	152	16.58	0.	58	18
Bacteria	28	8	600	151	16	0.	56	18
Molds	28	0.	4	1.1	.58	0.	2	18
Or above outside air:								
Temperature (°F.)	25	3	34	16.8	24	22	26	3
Carbonic acid	39	4.4	34.3	15.1	8.9	3.5	16.1	20
Organic matter	38	0.	31.4	7.8	1.1	0.	513	20

Of course it is hardly necessary to remark that the sanitary conditions in certain tenement houses, even where population is dense, may be much better, and the mortality in them even be lower than in the small crowded houses in country places; but on the whole the broad principles already enumerated are found to hold good, judged by results. Keeping these facts fully in view we may now turn to the examination of the spread of zymotic diseases by means of the public schools in Ontario. From time to time examinations of the public schools of some of the Canadian cities have been made, notably at times when diphtheria has been prevalent in them. I am not in possession of the statistics relative to the cubic air space of all Ontario public schools; but statistics published several years ago gave the following figures for Hamilton schools, viz:

Floor space.—Minimum legal space: 12.32 square feet, 120 cubic feet. Actual space from seat space: 10.7 square feet, 107 cubic feet. Floor space from actual attendance: 12.7 square feet, 127 cubic feet.

These latter facts showed that the influences deciding the number of organisms were not those of temporary cleanliness, but that the influences at work have a gradually cumulative effect These influences have been fully investigated by Emmerich, of Leipzig, who made a large number of analyses of the materials in the space between the floor of a room and the ceiling of the one below. To use his own words, he showed "there exists nowhere in nature, not even in the neighborhood of human dwellings, a soil so highly contaminated with nitrogenous organic substances and their decomposition products as the damping material

under the floor of dwelling rooms." He showed further that the carbonic acid resulting from organic decomposition in the air of empty rooms actually increased, although all other sources of carbonic acid were excluded. He further examined these materials in a prison at Amberg, in which had occurred persistently for years epidemics of croupous pneumonia which had attacked every seventh person and killed every twentieth prisoner. He not only found this material full of organic matter as usual, but also discovered Friedlander's pneumococcus in enormous numbers. The effect of this filth in pneumonia increases from 3.5 per 1,000 in the better houses to 6.6 in the three-roomed and 12.5 in the one and two roomed houses. The laws, which both from statistics and experiment are thus shown to govern mortality rates, are evidently dependent for their operation upon the fact that a house atmosphere, even at its best, is different from that of the external air in (1) its normal constituents, (2) its contained microbes, (3) its gases of decomposition, whether arising from the waste products of animal life or of dead organic matter, (4) its relative humidity, (5) its unequal distribution of temperature, thereby producing especially drafts. In this table the relative purity of the air in the better class of houses is admirably illustrated. It is of still more interest for the purposes of our subject to compare the carbonic acid and number of bacteria in the rooms with their amounts in the air of public schools. To make the difference still more evident it must be remembered that schools are occupied but six hours, while the houses are constantly occupied. Still greater differences are seen in the two classes of schools, the one being naturally ventilated by means of fireplaces, open windows, and ventilators in the ceilings, while the others were ventilated by means of fans over hot pipes. Thus, referring to the tables, it will be seen that while the number of bacteria in a liter of air in one-roomed houses averaged 60, that in naturally ventilated schools averaged 152, or two and one-half times as many, while that in the best ventilated schools was 18, or twice the number in four-roomed houses and upward. Further investigations were made into the source of the bacteria, and it was found that the bacteria in the air of a room were not materially increased by the presence of a large number of persons in a crowded room during a single lecture; neither did they come from the outer air introduced, it being relatively free from germs during these winter experiments. It was therefore concluded that the microbes came from the floor and other parts of the rooms. This was shown to be the case, and that their numbers largely depended on the cleanliness of the rooms. The schools were classified according to their length of time since construction, with the following results:

	Number of cases.	Micro-organisms per liter
Opened before 1866	7	211
Opened before 1875-1880	20	150
Opened before 1884-1885	5	38

I was recently called in to examine the sanitary condition of the public schools of one of our cities, and found the cubic air space on the average to not exceed 200 cubic feet per pupil, and this in two-story buildings. What this means in the matter of density of population is seen in the following figures: In a square acre there are 43,560 square feet. In a square mile there are 27,878,400 square feet. In a room 10 feet high, and allowing 200 cubic feet space to a pupil, the floor space for each pupil is 20 square feet. In the most densely populated Liverpool district, already referred to as having a death rate per 1,000 of 38.67, and of children under five years of 139.52, the population per square mile was 65,823, or that of these schoolrooms is twenty-one times as great. But it is practically double this in buildings of two stories, for without special ventilation the air of the two floors

is common to all the children. Without, however, pursuing this calculation any further, it becomes abundantly plain that in the limited amount of air of a schoolroom we have present a condition wholly opposed to the process of infinite dilution which is constantly going on in the outer atmosphere, and that any deleterious materials present in the air of schoolrooms has an opportunity for producing most certainly their evil effects. We have first of all, in naturally ventilated and crowded schools, a great increase of carbonic acid, amounting, even in rooms with an air space of 300 cubic feet, to 15 parts in 10,000, with a proportionate increase of organic matter. Extended most recent experiments by Merkel in Germany and by Haldane in England, referring to the effect produced by such air, force the conclusion that they are on the one hand due directly to the poisonous effects of an excess of carbonic acid and on the other to the absence of the normal amount of nascent oxygen necessary for oxidization of the blood. That these poisonous effects by directly depressing the system leave it an easier prey to specific bacterial poisons may naturally be inferred; but we now are in possession of experiments on animals which give direct proof of the fact. Roger has shown that the rabbit, which is naturally immune to symptomatic anthrax, quickly succumbs to the disease if at the same time there is injected a sterilized culture of bacillus prodigiosus. Chantmesse and Widal have found that a laboratory culture of the typhoid bacillus, which had lost all its virulence and was entirely without effect upon guinea-pigs, proved to be extremely fatal when the vital tone of the animal was lowered by a previous injection of a culture of proteus vulgaris. The virulence thus acquired became exceedingly intensified by further passage through animals. It has been shown, also, that physical conditions affect the power of resistance in animals. White rats, which are naturally immune to anthrax, easily contracted the disease when previously exhausted by being compelled to turn a revolving wheel. Sheep, which are naturally immune to anthrax, contract it when they have been artificially chilled. Anæsthetics have been found to act in a similar way. Platania produced anthrax in naturally immune animals (dogs, frogs, and pigeons) by inoculating them when under the influence of curare, chloral, or alcohol. In the altered relative humidity of the air of rooms in winter we have, however, what I believe to be a potent factor in the inoculation of children with the germs of diphtheria and other diseases of the respiratory mucous membrane. Everyone is familiar with the disagreeable sensations experienced in rooms heated by hot-air furnaces where no means is provided for the supply of moisture. I am not aware of any extended experiments on the subject, but the following is sufficient for purposes of illustration:

In a paper on the ventilation of schools, by Dr. J. J. Cassidy, presented several years ago to the Ontario Health Officers' Association, I find the following condition given of one of the best constructed, ventilated, and heated schools in Toronto:

January 26, 1887, 3:45 p. m.: Examination of the ventilation of Brock avenue school. Upper room (girls), cubic measurement, 10,786 feet; persons usually present, 59; cubic space per head, 183 feet; temperature, 67°; hygrometer, D. B. 67°, W. B. 53½°; R. H. 41½ anemometer; size of inlet, 4 square feet; air entering per minute, 266 linear feet; air entering per hour, 16,560 linear feet; cubic feet of air entering per hour, 66,240; number of changes per hour, 6.1; door closed and found windows closed; test of air by the senses, not close.

The mere amount of relative dryness in a schoolroom occupied by children is, however, no index of the evil influences of the air on the mucous membrane, since the exhaled moisture produced in a room filled with little children notably increases that of the room, but only by a process of drying out of the mucous membrane similar to that by which the evaporating pan is emptied of its water; the dry air, constantly inhaled, passes over the mucous membrane and abstracts an amount of vapor equivalent to about one-fiftieth of its volume, the air always being saturated when exhaled from the lungs. If 500 cubic feet of air be taken as the average

amount expired by a person in 24 hours, it is apparent that 10 cubic feet of an atmosphere consisting wholly of aqueous vapor is exhaled. It can readily be understood, therefore, how, in a schoolroom with 50 pupils, having an average air space per capita of 200 cubic feet, an enormous evaporation is constantly going on from mucous surfaces, when with this addition the air of the room, as in the examination given, has less than 50 per cent of saturation. It is manifest that if the normal air of the room has an average humidity of 75 per cent, or is three-fourths of saturation, it will extract very much less moisture than if at only 25 per cent of saturation. We have, however, to look to the contamination of the air with the specific virus of disease if we desire to explain the real and immediate cause of the spread of diphtheria and similar diseases by means of schools. I have already referred to the relative purity of external air as compared with that of house atmospheres. This may be illustrated by a comparison of the results obtained by Percy Frankland, F. C. S., in a suburb of London. Taking several days' average, he found 9,800 microörganisms per cubic meter of air which were mostly molds. From the experiments on the air of houses and schools already given I take the figure of the number of microörganisms in the air of a school of average cleanliness, naturally ventilated, and find it to be 124,000, and in the cleanest of mechanically ventilated schools, taken from 22 in all thus ventilated, there were 3,000 microbes per cubic meter. Where there are no such enormous number of microbes in school air as compared with outside air, the relative dangers would be proportionately great in the case of the school, from the fact that the same air is breathed again and again, if not by the same person, then by others, the ratio of change, even with good ventilation, as compared with the slightest breeze, being as 1 to 2,500.

But I need not multiply by illustration the dangers to which I have referred. Only one word need be said with regard to the conclusions to be drawn from them, which may be summed up as follows: (1) Diphtheria in houses is an intensely infectious disease. (2) It is a disease capable of a very mild character in some cases, while still retaining for several weeks in such patients the ability to transmit the infection and produce cases of extreme malignity. (3) It is a disease specially influenced, as regards its infectiousness, by the character and thoroughness of local treatment, and by the frequency with which the air of a sick room is changed. How this latter is true is shown by the effects on the number of microbes in mechanically ventilated schools. (4) It is a disease peculiarly liable to attack with malignity children under 10 years of age, but causes relatively fewer deaths than scarlatina among children under 3 years. (5) It is a disease the germs of which have, when hidden away in damp, dark spaces, where dead organic matter is present, a capacity for prolonged resistance to destructive influences. (6) It is a disease whose germs are weakened in their virulence by free exposure to sunlight, moisture, and free air, and these may be completely destroyed within a few days. (7) It is a disease which does not produce epidemics through the medium of public water supplies. (8) It is a disease which may be introduced into houses from defective sewers and bad plumbing; but epidemics in a series of houses on a street, or in a town or city, are never produced except by direct communication and direct infection; and this method of propagation has fresh scope and produces its most potent influences through the medium of public schools, and by persons and children visiting infected houses, and by persons from infected houses visiting in healthy homes. (9) It is a disease peculiarily frequent and fatal in the latitudes lying between the Ohio River and the northern limits of settlement in Canada. (10) It has no special habitat except that it is peculiarly a house disease, and finds its greatest opportunities for spreading in damp and cold climates, where the temperature makes people close their houses to natural ventilation, and where artificial heating is specially resorted to.

MEDIDAS QUE DEBEN TOMARSE PARA IMPEDIR EL DESARROLLO DE LAS ENFERMEDADES TRANSMISIBLES EN LAS CIUDADES.

Por el Dr. J. E. MONJARÁS,

Inspector General de Salubridad Pública en el Estado de San Luis Potosí.

El aislamiento, la desinfección, el saneamiento y la energía de la policía sanitaria, son los mejores medios para impedir la propagación de las enfermedades infecciosas en las ciudades.

La primera providencia que las autoridades deben tomar para mejorar el estado de insalubridad de una ciudad, es el aislamiento de las enfermedades infecciosas. El aislamiento puede ser individual, el que se dirige sobre el individuo solo colocado entre su familia; ó bien es colectivo, reuniendo en un mismo local, hospital de aislamiento, á los enfermos atacados de la misma enfermedad contagiosa.

El aislamiento en la familia se obtiene colocando al enfermo en la pieza más amplia de la casa, mejor ventilada, y alumbrada por el sol; dedicando al enfermo el número de personas extrictamente necesario para su asistencia, escogiéndolas, si fuere posible, entre las que hayan tenido un ataque anterior de la misma enfermedad; prohibiendo el contacto mediato ó inmediato de las demás personas que no esten comprendidas en estas indicaciones; dedicando para la asistencia del enfermo los objetos necesarios para su servicio, que solo entren en contacto con él y con las personas que le sirvan; desinfectando en fin en la pieza misma del enfermo ó en otra contigua dedicada también á su servicio, todo lo que tenga que salir ó ser sacado fuera de estas piezas, tanto las personas como los objetos. La ropa que ha servido al enfermo y en general todo lo que sea susceptible de lavarse será empapado en una solución al 1 por mil de bicloruro de mercurio, hervido durante media hora y en seguida enjabonado con 20 gramos de jabón de potasa por 10 litros de agua.

Para cumplir con todas estas medidas basta la autoridad del médico asistente y la buena voluntad de la familia.

Después de haber obtenido el aislamiento individual, las autoridades deben preocuparse del colectivo reservado á aquellos desgraciados que en sus casas no tienen ciertas condiciones higiénicas para efectuar el individual. El colectivo está encomendado á las autoridades y por él debe comenzar la activa intervención que la autoridad debe tomar para sofocar cualquier epidemia y prevenir en lo futuro el desarrollo de otras.

Demostrado está hasta la evidencia: 1°, que el aislamiento colectivo no aumenta la mortalidad entre los aislados, y 2°, que empleando ciertas precauciones de desinfección, las colectividades de enfermos infecciosos en hospitales de contagiosos, no crian focos de infección nocivos á los vecinos como se pudiera suponer.

Demostrado lo está igualmente hasta la evidencia, tanto por la experiencia como por la estadística, que los enfermos infecciosos atendidos en casas reducidas sin buenas condiciones higiénicas en medio de sus familias, en la necesidad de llevar vida común con ellos, constituyen muy activos focos de infección que propagan rápidamente una enfermedad epidémica. Se impone pues desde luego la necesidad de destinar un local con condiciones á propósito para aislar á todo individuo que atacado por una enfermedad trasmisible, no pueda aislarse convenientemente ni de su familia ni de los vecinos, empleando, si es necesario, la fuerza de la autoridad para verificar su aislamiento, y haciéndolo con las precauciones que para el caso se indican.

Una vez estudiada la cuestión del aislamiento individual, debemos resolver la mejor manera de practicar el colectivo, por pertenecer exclusivamente á las autoridades, pues el primero aunque pertenece también á ellas, solo los señores médicos pueden hacer que se realicen, empleando en cada familia todos los medios

imaginables para persuadirlas de los beneficios que resultan de su práctica, á la higiene privada y aún á la higiene pública, y esto es tan cierto, que en caso de resistencia podría ponerlo en conocimiento de las autoridades y aún recurrir al apoyo de la fuerza pública.

Las autoridades deben dedicarse pues á resolver esta cuestión: ¿Cómo se debe proceder al aislamiento colectivo? (1º) ¿Es preciso crear un hospital dedicado exclusivamente á abrigar á los enfermos infecciosos? (2º) ¿Es preciso destinar en un hospital general pabellones especiales? (3º) ¿Donde se pueden colocar estos hospitales especiales?

Dujardin Beaumetz, dice á este respecto:

En la larga y notable discusión hecha por Jauvel y Vallín en el Congreso Internacional de Higiene de 1878, encontramos las conclusiones siguientes que responden absolutamente á las diversas cuestiones que se acaban de proponer: (1) El aislamiento que más se acerca a la perfección, es el obtenido por medio de un hospital dedicado á una sola enfermedad ó á varias enfermedades infecciosas, pero tratadas en pabellones separados. Es también el más costoso y el más dificil da organizar. (2) Un pabellón distinto y perfectamente aislado de un hospital general, da una seguridad menor, pero aún suficiente. (3) La instalación es notablemente más fácil: Con servicios especiales sin comunicación con el resto de los edificios en medio de los cuales están colocados. (4) En cuanto al aislamiento en salas reservadas simplemente, contiguas á los servicios generales, es mejor sin duda que la promiscuidad, pero es de ordinario ilusorio y da una seguridad engañosa.

Será preciso pues, en cuanto sea posible, crear hospitales para las principales enfermedades infecciosas: á estas conclusiones llega Chantemps en su memoria presentada al Consejo municipal relativo á hospitales de aislamiento.

Queda por tratar un último punto práctico, relativo al aislamiento de los enfermos contagiosos, y es la manera de trasportarlos de sus casas al hospital.

No basta destinar para los enfermos contagiosos un hospital de aislamiento, es preciso aún trasportar estos enfermos á los hospitales é impedir que por su trasporte el enfermo se convierta en un agente activo para la propagación de la enfermedad infecciosa que padece.

Para obviar todo inconveniente es preciso crear un servicio de trasporte para los enfermos que se hará en coches especiales destinados exclusivamente á este objeto: dos son suficientes.

Estos coches deben ser desinfectados después de cada viaje y estar siempre á la disposición de cualquiera persona atacada de enfermedad infecciosa ó contagiosa.

Cualquier coche puede servir para el objeto; pero los modelos que se han adoptado por Jancenus en Bruselas, y de los cuales acompaño una fotografía, satisfacen perfectamente las exigencias higiénicas y económicas que demanda este servicio.

DESINFECCIÓN.

Una enfermedad infecciosa puede propagarse: (1), por el enfermo mismo y sus deyecciones; (2), por los cadaveres; (3), par los alimentos y objetos que han servido al enfermo; (4), por las personas en contacto con él; (5), por la pieza y casa del enfermo.

Para la desinfección se deben tener en cuenta todas esas consideraciones y las medidas deben referirse á, 1º, cuidados minuciosos de limpieza en el enfermo, en su pieza y en los objetos que se encuentren en contacto con él; 2º, frecuente renovamiento del aire de la pieza; 3º, la destrucción de los gérmenes infecciosos.

Los cuidados de limpieza consisten en lavar varias veces en el día al enfermo, cambiarlo de ropa cada vez ó lo mas frecuentemente posible. Limpiar las piezas con jergas mojadas en soluciónes antisépticas al 5 por ciento de sulfato de cobre por ejemplo, teniendo cuidado de hervirlas en seguida en agua durante media hora.

La destrucción de los gérmenes constituye la desinfección propiamente dicha en un enfermo, esta puede ser externa ó interna.

Desinfección externa del enfermo. Siempre que el estado del enfermo lo permita, se deben ministrar baños generales ó abluciones con esponja, empleando la solución de 1 por mil de bicloruro de mercurio ó la de 2 por ciento de ácido fénico, etc. Los cabellos deben ser cortados así como las barbas y el bigote, teniendo cuidado de mandarlos quemar. Ningún enfermo curado deberá volver á la vida común antes de haber tomado á lo menos tres baños jabonosos.

DESINFECCIÓN INTERNA.

Cualesquiera que sean las ideas que dominen con respecto á la naturaleza de las enfermedades infecciosas, todos están de acuerdo en que es preciso evitar las indigestiones y fermentaciones del tubo digestivo que predisponen y favorecen poderosamente el desarrollo de todas las enfermedades trasmisibles.

Desde que por los trabajos de Pasteur, de Chamean, Toussaint, se sabe á que punto las diferencias de medio de culturas modifican la actividad y vitalidad de los microbios patógenos, se está autorizado á buscar qué sustancias producen la antisepsia del tubo intestinal sin perjudicar á la economía.

La boca es la puerta de entrada y el foco de cultura de casi todos los gérmenes que existen en el aire. Es difícil que estos gérmenes penetren directamente en las ramificaciones brónquicas ; se les encuentra sin embargo, pero casi todos son detenidos por la estrecha abertura de la laringe y aún antes de la laringe por las mucosidades que tapizan las fosas nasales, la boca, las amígdalas y la faringe.

Gran número de estos gérmenes son tragados con la saliva y destruidos por el jugo gástrico cuando está normal ; algunas veces sin embargo, la infección de la economía tiene lugar por las vías digestivas ; pero frecuentemente encuentran en la boca misma, sobre todo cuando está mal cuidada, á la vez un medio de cultura y una estufa de incubación. En ella se desarrollan entonces esperando que haya una puerta de entrada directa ó una disminución de resistencia local ó general, para invadir el órgano más fácil y propagarse por toda la economía.

Basta recordar que Roux y Yercín en sus bellos estudios sobre la difteria, han examinado las mucosidades bucales de 45 enfermos de un hospital y atacados de de otro mal que la difteria ; en quince ó viente han encontrado la forma atenuada del microbio diftérico que puede tomar de nuevo su virulencia en condiciones más favorables. Anuque en este hospital, los diftéricos están aislados en un pabellón especial, se comprende que algunos gérmenes se encuentran en el aire. Los mismos autores han examinado la boca de sesenta niños de la Normandía en la playa del mar, en una localidad donde hacía largo tiempo no habia habido difteria, y veinteicinco presentaban en la boca el bacilo seudo-diftérico.

El papel de estas infecciones secundarias de origen bucal en el curso de enfermedades ya graves por sí mismas (fiebre tifoidea, tifo-pneumonia, pleuresia aguda) es ciertamente considerable y la cuestión merece ciertas investigaciones. Ya que esta infección sea secundaria ó primitiva, la indicación profilática es la misma; es preciso practicar la antisépsia de las fosas nasales, de la boca y del fondo de la garganta en sus pliegues por medio de lavados repetidos y prolongados, así como en los dientes por el cepillo.

Estos lavados pueden ser hechos con el agua adicionada de tinturas aromáticas donde predominen las esencias de canela, limón, badiana, etc., de los cuales Chamberland, Codeas y Meunier, demostraron hace poco tiempo las propiedades antisépticas. Sería preciso añadir en ellas naftol, salol ó ácido fénico que no son sustancias tóxicas ni capaces de alterar el esmalte de los dientes, y sí pueden contribuir á la destrucción de los gérmenes.

La siguiente fórmula que ha recomendado Dujardin-Beaumetz, me ha dado muy buen resultado: Agua destilada, 1.000 gramos ; ácido borico, 12.50 gramos ; timol, 0.25 gramo; acido fénico, 1 gramo; tintura de menta, XX.

Para las narices nada es superior á la solución de ácido bórico al tres por ciento, aspirado de manera que penetre hasta la faringe nasal.

Es evidente que para hacer eficaces tales lavados en la forma de gargarismos, deben ser repetidos varias veces por día de preferencia con líquidos calientes y ser bastante prolongados, para que el contacto con los puntos sospechosos dure cinco minutos ó más. Si estos cuidados no pueden ser tenidos todos los días rigurosamente por las personas sanas, particularmente al despertarse y al acostarse, lo que es muy fácil, á lo menos impónganse á los primeros síntomas de cualquiera enfermedad febril ó cuando haya catarro.

En cuanto á la desinfección intestinal, se puede obtener empleando diariamente de 25 á 50 centígramos de salol, sustancia que no perjudica al organismo aunque se use por largo tiempo.

Todas las secreciones de los enfermos deberán recibirse en una vasija (bacinilla ó escupidera) llena hasta el cuarto de su capacidad con una solución de sulfato de cobre al 5 y 1 por ciento de ácido clorhídrico: en seguida se les verterá en las letrinas.

También es necesario desodorizar y desinfectar estas evacuaciones que son una causa de contaminación del aire, del agua, y en general de todo lo que tocan: así es indispensable neutralizarlas antes de arrojarlas á los inodoros ó á los albañales, donde sus gérmenes podrían germinar. Si es verdad como lo ha dicho Budd que una sola evacuación tifoidea puede afectar la red de albañales de una gran cuidad. ¿No es necesario destruir los gérmenes patógenos que ellas contienen antes de arrojarlos á los inodoros ó á los albañales de la calle?

La desodorización y desinfección de las evacuaciones es algunas veces muy difícil sobre todo en ciertas enfermedades donde su putrefacción alcanza en el intestino un grado extraordinario; basta citar como ejemplo la fiebre tifoidea, la disenteria crónica, etc.

La desodorización más activa es la que produce el cloruro de zinc á la dósis de cinco partes por mil: hace desaparecer inmediatamente el olor: es al mismo tiempo á esa dósis un verdadero desinfectante: pero su manejo es algunas veces delicado, por eso aconsejamos de preferencia la solución de sulfato de cobre que indicamos y que produce el mismo efecto.

DESINFECCIÓN DE LOS VESTIDOS, DE LA ROPA Y DEMÁS OBJETOS EN CONTACTO CON LOS ENFERMOS INFECCIOSOS.

De nada sirve aislar los enfermos sospechosos, purificar los lugares que habiten, impedir que el aire contaminado se esparsa al exterior, si no se disinfecta minuciosamente la ropa y los vestidos que ha ensuciado. Todo el mundo conoce la frecuencia de los casos de viruela, de escarlatina, de difteria, de fiebre tifoidea, de tifo, de cólera, observados en las personas que lavan la ropa sucia que proviene de los hospitales donde reinan estas enfermedades.

En muchos hospitales ingleses se destruyen por el fuego los vestidos y ropa llevados al hospital por un enfermo atacado de una enfermedad transmisible. En Lóndres se ha propuesto cerrar momentáneamente, mediante indemnización, los talleres de ropa ó despedir á las costureras atacadas de enfermedades contagiosas ó asistiendo en su domicilio un caso de este género. En el Congreso de higiene de Paris en 1878, el Dr. Smith señalaba un caso de fiebre tifoidea, transmitida á un niño de ilustre nacimiento, por un vestido de baile que el obrero había cocido y ajustado en la pieza, y casi sobre el lecho donde dormía uno de sus niños atacado de esa enfermedad.

Dos medios nos parecen tener una superioridad incontestable para la desinfección: el calor y las fumigaciones de ácido sulfuroso; el cloruro de cal, el cloruro de zinc, las fumigaciones de cloro, de cinabrio, etc., quedan en un lugar inferior.

Estudiaremos en seguida cada uno de estos medios de desinfección bajo el punto de vista de sus aplicaciones y de su modo de empleo.

Insistiremos aquí sobre la diferencia de acción del calor, según que es seco ó húmedo.

He aquí los resultados que los experimentadores han obtenido, según que hayan empleado el calor sèco ó húmedo: (1) Las bacterias desprovistas de esporos no pueden soportar durante una hora y media la exposición á un aire caliente de 100° centígrados. (2) Los esporos de la podredumbre no son matados sino por la exposición durante una hora y media al aire calentado á 110° ó 115° centígrados. (3) Los esporos de bacilus no son destruidos sino por la permanencia de tres horas en una atmósfera de 140° centígrados. (4) El calor húmedo bajo presión destruye á 115° centígrados las bacterias y esporos más resistentes.

Haciendo aplicaciones en la práctica de estos datos, se hace preciso la resolución de las dos cuestiones siguientes:

(1) ¿Qué temperatura pueden soportar impunemente las materias de los vestidos y los tejidos?

(2) ¿Cuales son los aparatos que permiten hacer la desinfección por el calor?

ACCIÓN DEL CALOR SOBRE LOS TEJIDOS.

De una manera general los tejidos de lana se alteran más rápidamente que los de algodón. Es casi imposible conservar á los tejidos de lana la blancura que teñían cuando nuevos; pero una exposición durante dos horas á 110° no les da un tinte más amarillo que el que adquieren después del primer lavado por el agua caliente.

Esto es tan cierto que sometiendo á 110° durante tres horas una pieza de franela que ha sido ya lavada con precaución, es imposible encontrar una diferencia de tinte con una pieza idéntica que no ha sido sometida á este temperatura. Sin embargo, partiendo de 115° y sobre todo de 120°, la diferencia se hace sensible cuando la temperatura ha sido mantenida á lo menos dos horas.

Es pues solamente á temperatura de cerca de 150° que los tejidos de lana comienzan á perder su resistencia.

ACCIÓN DEL CALOR HÚMEDO.

La inmersión en el agua hirviendo y el mantenimiento de la ebullición durante una hora, es un medio eficaz y de fácil aplicación del calor á la desinfección. Este medio excelente y de uso diario para la ropa blanca y de cama, cesa de ser aplicado para los vestidos de paño y de algodón; la lana seca muy lentamente, muchos vestidos serían deformados y deteriorados por el agua caliente; la ebullición en el agua quita toda su elasticidad á la lana y á la cerda; en fin, algunos objetos, como pieles, no pueden ser sumergidas en el agua.

Es pues indispensable recurrir á aparatos, estufas de desinfección, en los cuales se emplea el vapor de agua con presión á 115° centígrados, que no altera los tejidos y produce una destrucción segura, eficaz, y rápida (media hora es suficiente) de los gérmenes más resistentes. El mejor modelo es el que acompaña esta memoria, marcado con el número 2; puede desinfectar grandes cantidades de objetos en muy poco tiempo.

Hay otro modelo móvil que puede ser empleado de casa en casa ó trasportarse á otros lugares donde se desarrolla una epidemia.

Mas como no siempre es posible tener esta clase de aparatos por el precio subido de ellos, aunque constituyen una verdadera economía tanto por lo barato que sale la desinfección, cuanto por el poco tiempo empleado, se puede recurrir al empleo del ácido sulfuroso.

ACCIÓN DEL ÁCIDO SULFUROSO SOBRE LOS TEJIDOS.

La combustión de treinta gramos de azufre en flor, diez de clorato de potasa y un poco de alcohol por cada metro cúbico, bastan para destruir los gérmenes más sospechosos. Lo mismo que hicimos con el estudio del calor, debemos hacerlo con el de este gas. Debemos buscar aquí ¿Cual es la acción del ácido sulfuroso producido por la combustión del azufre, en los tejidos y las partes accesorias de los vestidos, así como los objetos metálicos y otros?

Tenemos en este punto una grande experiencia, pues algunos miles de desinfecciones hemos practicado y podemos decir de una manera segura que en dósis de 30 gramos el azufre quemado por metro cúbico no produce las más veces ningún cambio en la consistencia de los tegidos de lana y de algodón, ya estén ó no mojados.

No es dudoso que empleando mayores dósis, se llegará á destruir la solidez de los tegidos.

Con respecto á la coloración es un poco diferente: casi todos los colores claros son desteñidos, así es que muy pocos quedan fijos después de la acción del ácido sulfuroso.

A los metales los hace tomar un color más subido que desaparece frotándolos.

LA DESINFECCIÓN DE LAS HABITACIONES COLECTIVAS Y PRIVADAS DEBE PRACTICARSE INMEDIATAMENTE QUE LA ENFERMEDAD HAYA TERMINADO.[1]

Tenemos como ejemplo un cuartel, una pieza, un dormitorio de colegio; hay que desinfectar los muros, los techos y los suelos; los mejores procedimientos son los que hacen uso de la lechada de cal recientemente preparada, ó la solución del bicloruro de mercurio al $\frac{5}{1000}$ adicionando ácido clorhídrico al $\frac{1}{100}$; para ello se debe emplear cepillos que permitan poner en íntimo contacto las paredes con el líquido, las bombas de Geneste y Herscher dan un resultado seguro en teoría, pero en la práctica casi siempre el resultado es dudoso.

La pintura con la cal, muy en boga en otro tiempo como medio de purificación de las paredes, cayó en descrédito por largo tiempo.

Los higienistas, hace poco todavía, la consideraban como un medio bastante grosero de blanquear las paredes; pensaban que no destruiría los gérmenes nocivos depositados sobre las paredes de los locales habitados; juzgaban indispensable, en las casas donde por economía se conservara la pintura hacerla preceder de una pulverización con una solución de sublimado al milésimo.

En fin, desde hace largo tiempo, las capas antiguas de pinturas eran consideradas como un receptáculo, casi como un foco de gérmenes antiguos, y la mayor parte de las administraciones civiles y militares han prescrito en sus reglamentos, raspar precisamente las capas antiguas de pintura.

Las recientes investigaciones de Richard y Chamtemesse, las de Libornis, Pfuhl, de Giasa, confirmando las observaciones ya viejas de Pettenkofer sobre la acción desinfectante y microbicida del agua de cal, han venido á modificar más adelante aquellas opiniones.

La pintura con lechada de cal ha dado los resultados más satisfactorios para la esterilización, no solamente de los polvos superficiales, sino también de las capas de pintura subyacentes penetrados por el líquido empleado.

La lechada de cal se prepara con 2 kilógramos de cal recientemente apagada, bien mezclada ó deshecha en diez litros de agua decantada solamente un cuarto de hora después, cuando todas las partículas gruesas se quedan depositadas en el fondo del vaso, de tal manera, que la lechada de cal obtenida no contiene en suspensión sino partículas extremadamente finas.

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[1] Proscribimos el uso del cloro por ser su manejo muy difícil y por que altera más que otras sustancias los tegidos y colores de los objetos.

Esta lechada de cal se manifiesta siempre estéril aunque el agua empleada no lo haya sido absolutamente y la pared en que se ha experimentado contenga un número de gérmenes muy considerable; siempre se ha encontrado esterilizada al cabo de 24 horas.

La ablución por soluciones de sublimado desde el 1 por mil hasta el 1 por ciento, adicionados de 1 por ciento de ácido clorhídrico, ha permitido comprobar á Mr. Lapanet de una manera bien clara, los resultados obtenidos por MM. Guttman y Merke y M. Bardoni Uffreduzzi, á saber que las solucions al 1 y 2 por mil son del todo ineficaces; que las del 3 y 4 por mil no dán sino una esterilización relativa poco segura, y que se necesita una proporción del 5 por mil para destruir de una manera cierta los gérmenes contenidos en la pared.

Después de varios ensayos nos proponemos emplear el siguiente modo de preparar pintura: Agua simple fría, 5 litros; cal recientemente apagada, 1 kilógramo. Se disuelve esta mezcla, se agita, después se deja reposar un cuarto de hora. Todas las partes pesadas como la arena que recubre la porción de cal apagada, las piedras calcáreas contenidas en esta se depositan. Es inútil añadir creta, la cal es bastante. Se decanta entonces, vaciándose en un cubo el líquido que sobrenada. En cuanto á las capas antiguas de pintura no contienen sino una cantidad insignificante de gérmenes inofensivos en las condiciones ordinarias.

Los gérmenes contenidos en los polvos adherentes á la superficie, son destruidos por la aplicación de una nueva pintura con lechada de cal bien preparada.

La operación costosa é insuficiente del raspado de la pintura vieja, es pues inútil.

El modo actual de preparación de la pintura es irracional. Ligeras modificaciones hacen su empleo más eficaz, bajo el punto de vista de la disinfección más simple y menos costosa.

Para la desinfección de los inodoros hay que tener en cuenta las tres formas ó sistemas que en las ciudades se emplean. (1) Inodoro en comunicación con los albañales. (2) Inodoro de fosa móvil. (3) Inodoro de fosa fija.

Para los primeros, se deberá emplear el agua abundantemente y una solución de 5 por ciento de sulfato de cobre y 2 por ciento de ácido clorhídrico.

Con los segundos y los terceros se practicará lo mismo, pero con menos agua y más sustancias desinfectantes por ser reducidas las fosas que los forman.

SANEAMIENTO.

La primera necesidad que hay que llenar al ocuparse del saneamiento de las ciudades es la de proveerse de agua potable; notoria es la escasez de este precioso líquido en muchas ciudades, y sin embargo, aún en estas circunstancias, una intervención rápida y eficaz podría aumentar su cantidad.

Las autoridades se deben preocupar mucho de la instalación de pozos artesianos que debido á los progresos de la ciencia y de las artes se llevan ahora á cabo en poco tiempo. Dicho sea esto sin perjuicio de la construcción de presas ú obras especiales á cada localidad, pero que aseguren 150 á 200 litros por persona cuando menos.

Es preciso entubar el agua desde su origen para evitar todo contacto prolongado del agua con el aire, pues si bien es cierto que este elemento no contiene en las capas superiores gran cantidad de gérmenes zaprofitos ó patógenos, lo es también, que existen en las inferiores, sobre todo después del barrido de las calles, y que ellos contaminan de una manera enérgica el agua de las fuentes ó de los tubos que estan á su alcance. Evitar también y á todo precio, que las materias de los albañales ensucien estas aguas, sea accidentalmente, sea de una manera constante como sucede en las ciudades que hacen uso de agua de río ó lago para alimentacíon, y que á la vez dirigen á estos lugares los albañales. El agua potable cuando sea sospechosa

deberá inmediatamente esterilizarse mezclándole 40 centígramos por litro de la siguiente fórmula para las que no tengan ó tengan pocas sales calcáreas: Polvo de cal viva, 9 partes; polvo de carbonato de sosa, 5 partes: polvo de alumbre, 1 parte; polvo de sulfato de fierro, 1 parte. Mézclese bien y guárdese del contacto del aire.

Para las aguas que contengan sales calcáreas, se empleará la misma fórmula y la misma dosis sin el sulfato de fierro.

En sequida viene la necesidad de resolver higiénicamente el alejamiento de las inmundicias; para esto el agua hace también mucha falta, principalmente para los inodoros que están en relación con los albañales y que forman el sistema de Tout à l'Égoût.

Para los que tienen el sistema de fosa móvil, se proveerá la autoridad de uno ó más carros que á cierta hora recojan las inmundicias de los inodoros, y los trasporten al local conveniente.

Lo mismo se hará con los que tienen el sistema de fosa fija, procurando substituir estos con aquellos.

Los caños públicos deben ser desinfectados en tiempo de epidemia mediante grandes cantidades de sulfato de cobre (5 kilógramos por metro cúbico de materia por disinfectar vertidos en soluciones al 5 por ciento, por la boca superior, y mediante fumigaciones de azufre hechas por su boca inferior).

Para la limpia de las calles, se deberá emplear el número de carros necesarios, de tal manera que puedan pasar tres veces por cada esquina, y obligar á los habitantes de la ciudad á que guarden la basura en sus casas, hasta que el carro pase por frente de ellas.

Se formarán cuadrillas de hombres para que limpien con frequencia las calles, poniendo lechada de cal en la tierra donde haya materia fecal humana ó de animal.

Tanto las basuras como las inmundicias deberan ser llevadas á un lugar situado á dos kilómetros distantes de la ciudad y ser quemadas las primeras y revueltas las segundas con tierra para utilizarlas como abono.

POLICÍA SANITARIA.

La primera providencia que se debe tomar es aplicar con todo rigor todos y cada uno de los artículos de los reglamentos relativos á las enfermedades trasmisibles: en el caso que no existan, dar disposiciones que variarán en cada ciudad pero que tendrán por base los cuatro puntos que tenemos recomendados.

Se nombrará para cada cuartel de la ciudad un subinspector, médico titulado: y para cada manzana, un manzanero encargado de la desinfección de las casas y de tomar noticias diarias de los casos de enfermedades infecciosas que ocurran, marcha de la enfermedad, condiciones higiénicas de la casa donde tal degracia haya, elementos de la familia del paciente, y demás informes conducentes. Diariamente los manzaneros darán cuenta de lo ocurrido en su respectiva manzana al subinspector del cuartel, para que este reuniendo los datos que le trasmite el manzanero, los aprecie debidamente, rectificándolos ó ratificándolos, y dé cuenta diaria á la oficina general de higiene.

Los manzaneros son los directamente designados para la desinfección. Las sustancias con que esta deba hacerse, estarán bajo la vigilancia y distribución de los subinspectores, en un depósito que se construirá en cada cuartel y de donde se repartirán á los manzaneros, con un vale de los manzaneros conforme las necesidades que indique su papeleta. Los manzaneros recorrerán diariamente su manzana, informándose de lo que en cada casa ocurra acerca de la enfermedad infecciosa. En caso de que en una familia se encuentre un enfermo de tifo y la casa no preste comodidades para aislarlo ó no lo haga la familia, dará parte inmediatamente al subinspector, quien por medio de la policía hará que se cumpla con lo prevenido en el reglamento respectivo.

Cuando los elementos de la familia no permitan atender al enfermo convenientemente, los subinspectores lo harán trasportar en el acto al hospital de aislamiento.

Mas si solo le faltan recursos para pagar un médico y la compra de medicinas, el subinspector se prestará gratuitamente á curarlo, ministrándole por cuenta de la inspeccion los médicamentos necesarios.

Se redoblará la vigilancia de los inspectores de bebidas y comestibles, para eliminar del consumo público las substancias alimenticias sospechosas.

CONCLUSIONES.

(1) El aislamiento individual deberá permitirse solo á aquellos enfermos que tienen los elementos necesarios para practicar las medidas que evitan el contagio. (2) El aislamiento colectivo de los enfermos atacados de males transmisibles debe ser obtenido en hospitales destinados exclusivamente á cada una de estas enfermedades ó cuando menos á un grupo de ellas; deben estar perfectamente aislados uno de otro los pabellones que contengan enfermedades distintas. (3) Ambos deben ser vigilados por la autoridad sanitaria y á su satisfacción. (4) La desinfección para que sea eficaz deberá practicarse en las secreciones de las personas, ropas, y objetos, que tuvieron contacto con él, y en la pieza y casa que habitaren. (5) La desinfección de los muros puede hacerse ó con bicloruro de mercurio ó con lechada de cal ó ácido sulfuroso. (6) Para que el sublimado desinfecte las paredes, suelo, y techo de las piezas, es preciso usarlo en soluciones al 5 por mil, adicionadas de ácido clorhídrico al 1 por ciento. (7) Para que el agua de cal sea eficaz se necesita que esté recientemente apagada, y que sea en la proporción de 1 por cinco partes. (8) El ácido sulfuroso es infinitamente menos eficaz que los dos medios anteriores y exige que el local esté precisamente cerrado herméticamente. (9) El saneamiento de las ciudades se arregla según las circunstancias de cada localidad, pero tiene por base: proveerla de agua potable en cantidad de 200 litros por habitante y por día, cuando menos; asear las calles y las casas; alojar de las ciudades por conductos impermeables las inmundicias antes que entren en fermentación. (10) La policía sanitaria para que sea eficaz debe tener por base la aplicación inmediata de las medidas sanitarias por agentes suficientemente instruidos, en numero bastante según las necesidades y con facultades autoritativas que les permitan hacerse obedecer por todos. (11) Por último, solo los empleados sanitarios deberán practicar el aislamiento, la desinfección, el saneamiento y lo relativo á policía sanitaria.

THE EARLY DETECTION OF PHTHISIS, INCLUDING THE AUTHOR'S CONTRIBUTIONS TO DIAGNOSTIC MEANS, WITH AFTER CONSIDERATIONS OF A POSSIBLE PRETUBERCULAR STAGE.

By CHARLES DENISON, A. M., M. D., of Denver, Colo.,

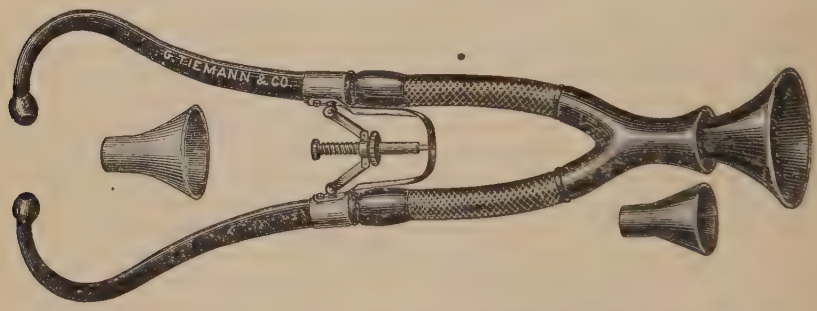
Professor of Diseases of the Chest and of Climatology, Medical College, University of Denver; ex-President American Climatological Association; Author of Climates of the Rocky Mountain Health Resorts.

It is very generally claimed by the enthusiastic friends and reviewers of various health resorts, where consumptives are invited to seek relief through climatic influence, that the resorts are favorable if the invalid comes in the incipiency of his disease. No matter what various and questionable combinations of climatic attributes exist in a given locality, the fact of an invalid coming too late, when the progress of his disease had advanced too far for recovery, is always held in reserve as a possible excuse for the death which is to take place. So everywhere is seen the importance of the early detection of phthisis, making the diagnosti-

cian's lot at the same time most important and difficult. Undoubtedly the existence of softening in lung tissue and the positive evidence of tuberculosis afforded by tubercler bacilli being found in the patient's sputum are too generally depended upon for a positive diagnosis. It ought to be the rule that conclusive evidence is generally reached and proper remedial measures, climatic and otherwise, settled upon before such serious symptoms become prominent. Thus the mastery of the disease would be much simplified. It is with a hope that my personal studies of this important problem have added something to our diagnostic resources that I am emboldened to present them in lieu of a comprehensive essay on diagnosis. The limit of time at my disposal will be my excuse for this fragmentary method of treating this subject by presenting the following means of diagnosis which I have devised or experimented with, namely, (1) the binaural stethoscope, (2) the spirometer, (3) the manometer, (4) the diagnosis by tuberculin (Koch's).

THE STETHOSCOPE.

The instrument which bears my name is so well suited, when properly made, to illustrate what I consider the essentials of a perfect stethoscope that I will not apologize for enumerating here its good qualities.



The smooth inner caliber.—Large size and gradually decreasing from the bell to the ear ending, in imitation of the speaking tubes used for deaf persons. The law of sound is like that of light transmission, i. e., the angles of incidence and reflection are equal, and this transmission is aided by the trumpet-shaped bell and gradually decreasing size of the smooth inner surface of the tubes.

The continuous transmission of sound.—This must be natural; so hard rubber or celluloid are preferable to metal for the tubes, as the latter gives a high pitch and metallic quality to the sounds heard. The joints between the bells and the main tube, and between the arms and the flexible tubes, are made by the even and perfect fitting of slightly conical tubes into each other, making the whole instrument as if of one piece as far as the transmission of sound is concerned. Probably a larger part of the sound is transmitted through the stethoscopic substance than through the hollow cavity.

The construction of the flexible tubes.—The coiled wire for these tubes, which lines the usual rubber tubes and is itself lined with smooth, soft rubber, is made to impinge at each end of each tube against the gutta-percha, so that a nearly perfect transmission of sound is obtained. This is the part that Tiemann & Co., of New York, alone have succeeded in rightly making, and it is an important feature of my stethoscope. The cheapening of the instrument by substituting symmetrical sized in place of the original conical flexible tubes, as in the instrument now sold by Charles Truax, Green & Co., of Chicago, seems to be accomplished with the loss of a very little only of sound-transmitting power.

The ear endings as lately made are acorn shaped, with openings so turned as to be directed toward the drums of the ears. This is a compromise from what I wanted, which was to have the lower and forward side of these ear tips bulge so as to fill the space behind the tragus and leave the hole above and back immediately in front of the auditory canal. The difficulty of fitting variously shaped ears with perfectly adapted ear tips is considerable with any other than the even, conical pattern, but I think ought to be overcome.

The spring attachment to pull together the arms is purposely excessive and also adjustable, so that all the pressure of the ear tips can be obtained that the listener can stand with comfort. This much pressure is desirable for perfect transmission of sound.

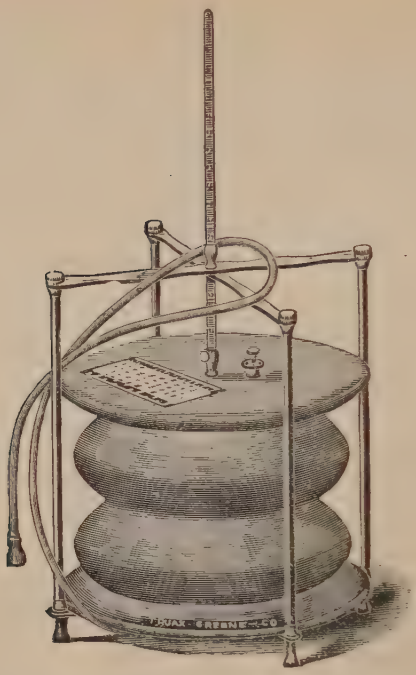
The ordinary bell endings are as follows: The stationary bell, with slightly flaring rim 1⅛ inches in diameter, which is large enough to use in examination of infants and in the detection of valvular lesions. The medium-sized bell, which has a rim of 1½-inch diameter, and sufficiently flaring to give a good impinging surface against the chest, is the size ordinarily used. The soft-rubber bell, rather thin and flexible, is intended to crowd into the medium-sized bell, giving a one-fourth-inch projecting rim of soft rubber for use on uneven surfaces, as in much emaciated consumptives.

The large bell for stethoscopic percussion.—This is not, as has been assumed, for use held against the chest wall, but for gathering the waves of sound emitted from the mouth during expiration while forcible percussion is being made over portions of the lung, where softening, bronchiectasis, or excavation is suspected. The concussion of the air contained in the thorax carries with it the succession, the cavernous, or the cracked-metal sounds which accompany the three above-named conditions, and by holding this large bell 1 or 2 inches from the patient's mouth, and percussing during expiration, they are distinguished better than can be done in any other way. Indeed, in thin-chested persons, with superficial excavations connected with a main bronchus, the finger-nail percussion will nicely and accurately outline the limits of the excavation. The cracked-pot or hollow sounds are altered in various ways; a slushy or succussion quality being sometimes imparted to either, according to the amount of moisture or breaking down which complicates the condition. I believe that the importance of the question of the first breaking down of lung tissue elevates this stethoscopic percussion to a first place in the art of physical diagnosis. It is certainly coëqual with any ordinary percussion, and only second, if inferior at all, to auscultation.

The test which I suggest for determining the relative perfection in transmitting power of a stethoscope is to put a watch on a show case or table, cover it with the palm of the hand, and then press the bell against the back of the hand. The clearness with which the working of the machinery is heard is the criterion of perfection in the instrument. By this test seven-eighths of the other stethoscopes sold fall short of their proper utility. The importance of depending upon an instrument as nearly perfect as possible in sound-transmitting power makes this test of a stethoscope especially valuable.

THE SPIROMETER.

The spirometer here described is recommended for its simplicity of construction and the ease with which the vital capacity of a child, a woman, or a strong man may be shown by it. With this instrument there is not resistance enough to the expired breath to hinder its use by anyone, and it is gauged for the accurate measurement in cubic inches of the vital capacity. It is made of a light elastic closed bag in the form of a bellows, with a top and bottom attached so that they move parallel to each other within a frame of nickel rods, each inch movement of the center recording rod being about equal to 50 cubic inches of air in the expanding



bellows. The accompanying cut gives the form of the instrument, and the annexed table gives the best records at hand for comparison of vital capacities, according to sex and height. It is to be noted (see table) that the greater capacity of the college men for increasing heights above 5 feet 7 inches simply illustrates the advantage training gives for the advanced students in such an institution.

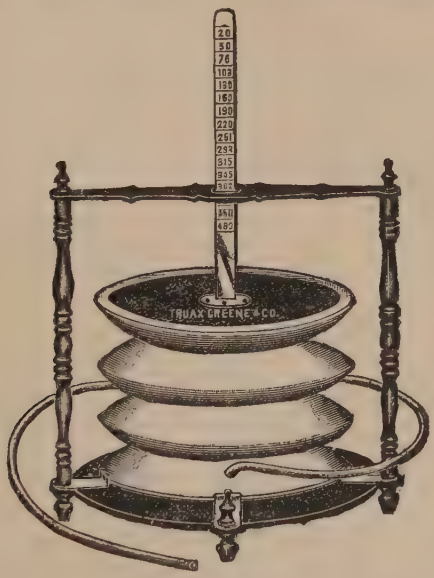
Standard vital capacity table.

[Computed by Hutchinson from 5,000 observations.]

Height.		Males.	Females.	Height.		Males.	Females.	2,230 Amherst College students' (males) gymnasium record.
Ft.	*in.*	*Cub. in.*	*Cub. in.*	*Ft.*	*in.*	*Cub. in.*	*Cub. in.*	*Cub. in.*
4	7	126	88	5	5	206	168	194
4	9	142	104	5	6	214	176	210
4	11	158	120	5	7	222	184	224
5		166	128	5	8	230	192	240
5	1	174	136	5	9	238	200	256
5	2	182	144	5	10	246	208	270
5	3	190	152	5	11	254	216	286
5	4	198	160	6		262	224	302

As far as my own experience goes I believe the diagnostic value of the spirometer in chronic lung diseases has never yet been duly appreciated by the medical profession. It is either because spirometers have been too expensive and faulty in construction, or because the mechanical conditions due to disease and affecting the air pressure and volume within the thorax are not understood, especially the contracting or shrinkage of affected lung tissue due to nature's effort in healing, or the natural process of arrest or encapsulation of tubercular affected portions. This shrinkage or impaired movement once accurately measured by separately

taking the movements of the two sides of the chest (from the center of a dorsal spinal vertebra to the marked center of the sternum), and the proportionate data are furnished, including the spirometrical record of the individual, for computing the comparative amount of work the two lungs are doing. Thus I have formulated the following, which is submitted as a rule for determining lung ventilation: Suppose the normal spirometrical record of a patient is only half what it should be for his height, and the expansions of the two sides are as 1 to 2, then, if no defect or disease exists in the better lung, it is well to assume that the lack of ventilation in the other lung is almost complete. It is practically as bad as if there were no expansion at all of the affected side, which would surely indicate that all of the spirometrical record in that case came from the unaffected lung. With both lungs differently affected, however, the feebler lung could be said to be doing from a little up to, say, about one-third of one lung's share or one-sixth of what the two lungs together ought to do in health. In view of the various mental impressions



which the physical signs of dullness and diminished movement may cause in different observers, such a means of positive measurement of lung impairment or inactivity as the above rule and method afford should certainly be appreciated as an invaluable guide with which every physical diagnosis ought to harmonize or due explanation be afforded why it does not. The spirometer may not indicate the disease, but its use is so important that the physical examination must make clear the spirometrical record of a given patient, or that examination is untrustworthy. How important, then, that every physician, when examining a chronic lung case, should know what the vital capacity of his patient is, that he may be satisfied himself that his conclusions are correct, as well as that he may do his patient full justice.

THE MANOMETER.

As a means of determining the strength of the elastic lung tissue, the amount of which the spirometer has given; as a proof of the fibroid healing, which is nature's method of arrest in most lung infarctions, and in the encapsulation of tubercle bacilli, the manometer is a valuable adjunct to the physician's armamentarium. Many persons, too, with a tendency to fibroid lung shrinkage will find the

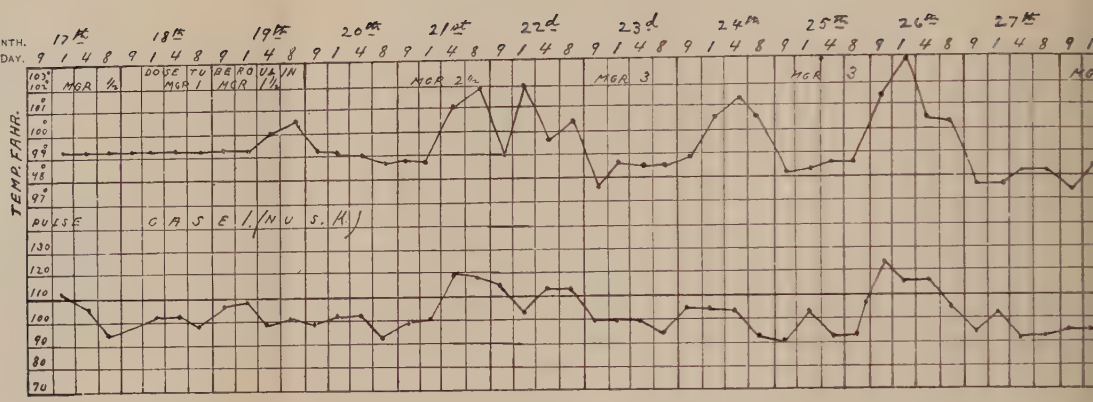
manometer to afford a means of respiratory gymnastics, which will be the better appreciated when one sees how nicely the loss or gain in respiratory vigor which is the result of any given method of treatment can be kept track of.

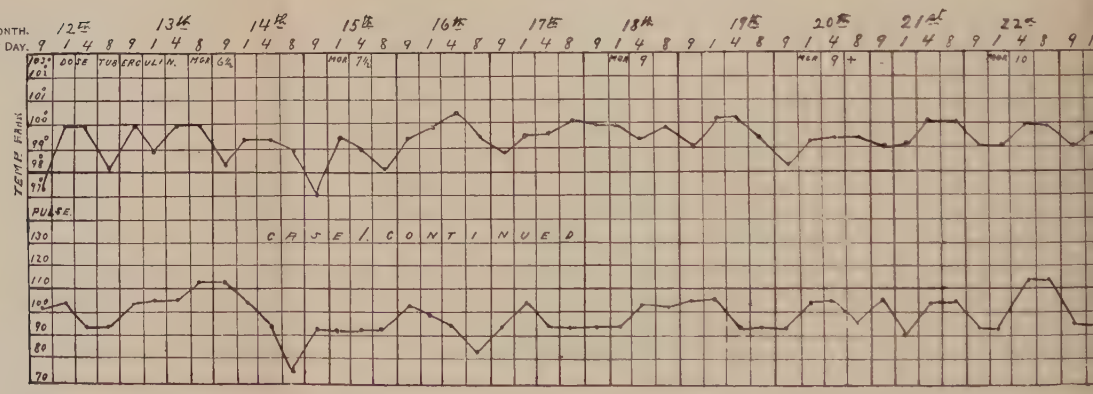
Direction for using.—After a moderate inspiration blow in the tube steadily with increasing force, same as in using a trumpet, until your full expulsive power is realized. The manometer records the elastic tension which the air cells will stand under a forced and sustained expulsion of air from the chest, as compared with the average of a healthy man. This strength is indicated on the index, i. e., the point to which the top of the mercurial column is pushed down in any instance. This is expressed in millimetres of mercury, the average for a healthy, strong man being 100 millimetres, or about 2 pounds pressure; and for women about 75 millimetres. A deficiency of, say, 30 per cent from these standards for healthy persons needs to be explained by a careful physical examination, excluding an occasional inability to appreciate how to breathe in this instrument, and it can be concluded that such deficiency indicates weakness and perhaps latent disease, especially if there is also inequality of movement of the two sides of the chest or the spirometrical record is likewise defective.

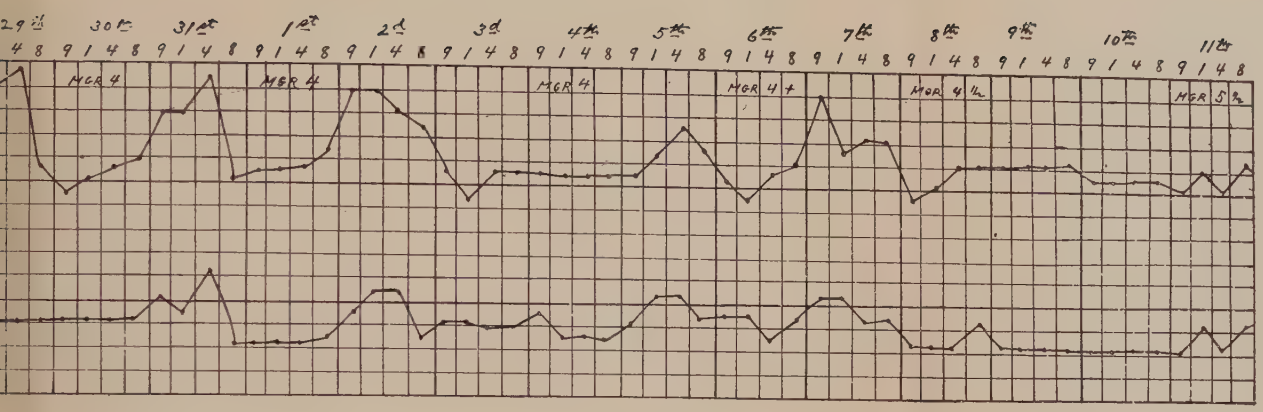
The manometer record is sometimes good in old cases of deep-seated bronchiectasis, in which the spirometer, previously described, is peculiarly diagnostic. It seems to happen this way: Toward the end of a full expiration into the spirometer, there being no resistance to the outgoing breath, such a contraction or spasm of the protective fibroid tissue around the cavity is excited that the foul contents are regularly thrown out in expectoration when that particular exhaustion of the air in the lungs is reached. Of course emphysematous persons, for whom, if the condition is recent, the manometric record is usually deficient, should not use this instrument, except simply for diagnostic purposes.

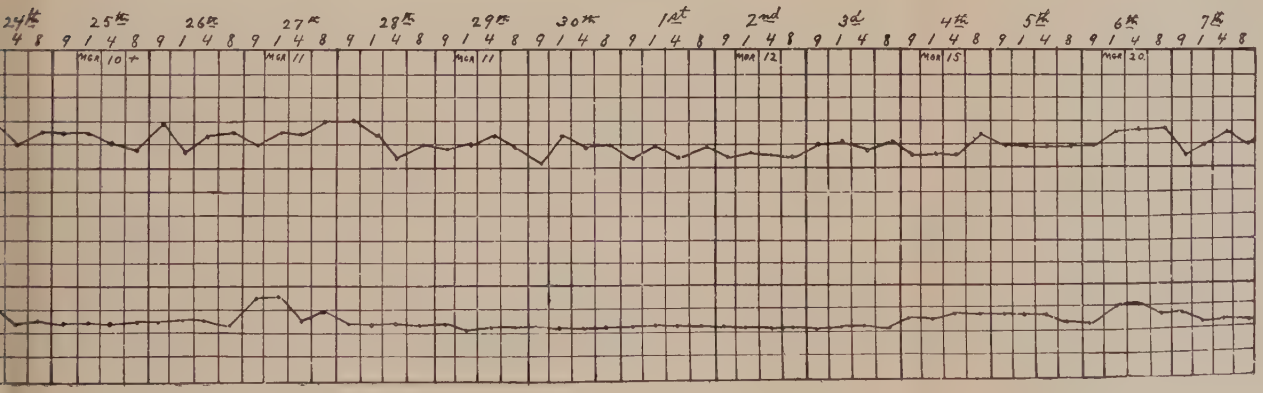
THE DIAGNOSIS BY TUBERCULIN.

It is not my purpose to throw undue discredit upon our means of diagnosis of phthisis in its incipiency. Theoretically, so far as our text-books go, the profession may seem to be well fortified for the work, but practically, whether due to defective means, method, or conception on the part of the physician, there are too often cases of evident tuberculosis unrecognized till such a time that the most favorable season for arresting the process has already passed. Without here going into the details of the early physical signs of phthisis, it is sufficient for our present purpose to show that in these uncertain and doubtful cases Koch's new discovery, tuberculin, has the power to bring to our knowledge their true nature and extent with precision and gratifying certainty. For the proper appreciation of this wonderful power some familiarity with or knowledge of the local reaction of the remedy in tubercular lung tissue is necessary. In my report on "Tuberculin and the Living Cell" to the American Climatological Association, in 1892, I reiterated what I believed I had been the first to discover the previous year, that this reactionary effect "consists mainly in a harsh, puerile, or an exaggerated bronchovesicular breath sound, as heard with the stethoscope over the affected area. This is an exaggeration of what was heard before the tuberculin reaction, or it is heard in localities in which the breath sound was previously inaudible or very different. It is not an evanescent effect, but usually continuous, though in a lessened or lessening degree during the whole course of treatment." Sometimes this local lung reaction is very feeble, while the systemic reaction, as shown by temperature, pulse, etc., is quite marked and characteristic. The following is an excellent illustration of tuberculin diagnosis in a case where neither the physical signs nor a microscopic examination of sputum could satisfy my decided suspicion that the case was of a tubercular nature.


DAYS OF MONTH.
HOURS OF DAY.
17th 18th 19th 20th 21st 22d 23d 24th 25th 26th 27th
TEMP. FAHR.
DOSE TUBERCULIN
MGR 1/2
MGR 1
MGR 1 1/2
MGR 2 1/2
MGR 3
MGR 3
PULSE
CASE I. (NUS. H.)


DAYS OF MONTH.
HOURS OF DAY.
12th 13th 14th 15th 16th 17th 18th 19th 20th 21st 22d
TEMP. FAHR.
DOSE TUBERCULIN.
MGR 6 1/2
MGR 7 1/2
MGR 9
MGR 9 +
MGR 10
PULSE.
CASE I. CONTINUED


29th 30th 31st 1st 2d 3d 4th 5th 6th 7th 8th 9th 10th 11th
4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8
MGR 4
MGR 4
MGR 4
MGR 4 +
MGR 4 ½
MGR 5 ½


24th 25th 26th 27th 28th 29th 30th 1st 2nd 3d 4th 5th 6th 7th
4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8 9 1 4 8
MGR 10 +
MGR 11
MGR 11
MGR 12
MGR 15
MGR 20

Case 1.—Mrs. K., Chicago, aged 24, married four years, height 5 feet 4 inches. No hereditary tendency to consumption. Seen one week after arrival in Colorado. Weight, 102; usual weight, 130. Gradual loss of weight since a miscarriage two years previously, after which she had influenza. While at school, aged 16, had dry cough and irritation in throat thereafter. Free from this two years in Europe, and then worse in 1889. Lately a wheezing and stuffed-up condition toward evening, sometimes had to sit up all night and frequently had to go to an open window at night during the past year. This was evidently a case of complicated asthma, for there was a considerable relief of the hard breathing on arrival in Colorado. Expectoration, dark yellow; cough, spasmodic; circulation, poor; patient, pale but catamenia regular; pulse, 94; respiration, 20; temperature, normal 10 a. m.; spirometrical record, 125; manometer, 45 millimetres; chest expansion, 2 inches, evenly proportioned to the two sides. The physical signs were not very marked. The expiration was generally prolonged. There was tympanetic resonance over left main bronchus, and cog-wheeled respiration and blowing expiration left mammary region. Feeble voice sound and broncho-vesicular respiration left apex rear. On the right there was slight dullness and broncho-vesicular breathing front and rear at apex and the voice was somewhat exaggerated in the rear. There were no bacilli in the sputum. The diagnosis was asthma and probably broncho-tuberculosis, and it was decided to test the case with tuberculin. The accompanying diagrams show the characteristic tuberculosis reaction to tuberculin, so far as the pulse and temperature are concerned, taken four times a day, according to the method I have employed for three years.

The local lung reactions were first manifest, after the 2½-milligram dose, in the left mammary region, where the cogwheeled breathing was before, and on the right side, at the junction of the third rib and its costal cartilage. After the 4-milligram dose these stethoscopic signs were also noted above in both first interspaces. These sounds were accompanied, when the temperature rise was great, with decided general reactionary symptoms of slight chill, fever, malaise, and headache. The sounds, however, at first dry, became softer and less pronounced as reactionary signs subsided, till they were about gone at the 60-milligram dose, when the patient, much improved in weight, strength, feelings, and freedom from the old spasmodic coughing spells, did not react, though a rise of 10 milligrams every third day was given thereafter. Note that the dose can be increased much more rapidly in such a case than in one in which there are any advanced tubercular lesions in the lungs. In the latter condition, of course, such marked temperature reactions should not be tolerated. Note also that the general reactions, as indicated by the temperature rise, reached their maximum on the day following the injections. From this fact alone it is reasonable to conclude the general dysceosia exceeds any existing local lung lesion. I conceive that the more rapid capillary circulation in lung tissue, five times more than in the periphery of the body, may account for some of the quick reactions (in three to five hours) in tubercular lung tissue.

In my considerable experience with Koch's tuberculin, and lately with Kleb's tuberculo-cidin, this gratifying diagnosis and result has been exceeded for certainty of effect by only two cases, which are worthy of more extended mention than we can give them here.

Case 2.—Dr. G., of Vermont; aged 38. Positive inheritance, his mother and five sisters, out of seven in family, having died of consumption. His wife had died of tubercular meningitis three years previously, from whom he may have been infected, as the disease was general in her. He had had a seton put in the back of his own neck twelve years ago for meningitis, which seemed to be relieved, and eight years ago had suffered fracture of the ribs, with septicæmia resulting. Three years ago had la grippe and double pneumonia, more severe on the right side, and was sick six months; came then to Colorado, and gained 17 pounds in as many days. November 20, 1892, after a cough in Vermont, had what was termed basal meningitis and has been sick ever since. Headache continuous, and lately very severe up to April 20, 1893, when in Colorado the following described relief came: There was no expectoration to examine, and only slight dullness, lessened movement, increased fremitus, exaggerated voice sounds, and broncho-vesicular breath sounds on the right side. The temperature, pulse, and respiration were found to be regular for two days—98.5° F., 60, and 20, respectively—when 1 milligram of tuberculin was injected. The genuine diagnostic reaction did not start till twenty-two hours afterwards, and then was chiefly general and not local in the lung. It was manifest by temperature, 100.5° F., and pulse, 82 to 90, and continued more or less for about fifteen hours, during which at one time he vomited. The day following its cessation a slight increase in dose of tuberculin was given, which

was followed, in four to six hours, by a slighter reaction than before. By that time the headache had entirely ceased, and the patient, who had been confined in bed for four weeks, was enabled to be daily out of doors with comfort. The constriction about the base of the brain, which was marked with the first reaction, gradually disappeared. In less than four weeks, after reaching a dose of 13 milligrams, and feeling well able to do so, the doctor returned to his Vermont home, where he has been engaged in practice since, enjoying, so he says, good health. This remarkable case is given as possibly the first diagnosis of tubercular meningitis by tuberculin on record.

Case 3.—A case of tubercular arthritis in both knee joints in a young lady of 28, who was taken thus while nursing a sister in an Eastern sanitarium who died of tuberculosis of the bones of the pelvis and spine. Three years afterwards, after having tried in hospital several kinds of surgical treatment, the patient referred to submitted to a test with tuberculin at my suggestion. She had lost the use of her limbs and was compelled to use a wheel chair for locomotion. The reaction at the 3, 6, 7, and 9 milligram doses of tuberculin were both general, i. e., headache, malaise, some fever, and general distress, and somewhat local in the left lung, where at age of 16 she had suffered some slight disease. Seven months after this diagnosis an attack of la grippe seemed to center the tubercular poison in glands on the left side of the neck, which, being removed, showed tubercle bacilli in giant cells in the center. This confirmation of the previous diagnosis led to a continuance of the tuberculin treatment in Colorado, from October, 1892, to May, 1893. The result has been successful, for the young lady, now in Vermont, enjoys excellent health and walks considerable distances without her crutches.

Other instances of decided diagnosis of tuberculosis, if cited, would include two cases of tubercular ulceration of the colon; lymph-adenoma, with general glandular involvement; scrofulous cases (glandular), and supposed pulmonary fibroses. An important consideration to be drawn from some of the above and other of my cases is that there is an active tubercular stage, pretubercular, if you wish to call it so, before the bacillus of tubercle makes its appearance as a factor in the case, so far as we are able to judge. I do not refer to such manifestly tubercular cases as where the full clinical picture of an acute phthisis is given, although the bacillus of tuberculosis can not be microscopically demonstrated in the sputum: perhaps as with a young lady patient I have in mind, whose expectoration was loaded with spores one week and the next gave 50 bacilli to the field, the first found in her case. Nor is reference intended to be made to other cases where active tuberculosis can be inferred as going on away from the bronchial tract, and the more acute and septic on that account; i. e., because the bacilli are not thrown off. But reference is intended to those intricate, slowly acting blood changes, which come under the classification of dyscrasiæ, which may be, for all that we know, the *sine qua non* of the existence of the bacillus of tuberculosis, that state which may indicate the more or less complete annihilation of the body's natural antagonism to this particular foe. If our judgment and means of knowing the first appearance of the bacillus are not wholly at fault, then there is certainly enough in this idea of a definite pretubercular state to bring great credit upon him who will elucidate this interesting and important problem.

Among the phases of this subject to be solved the following appear to me to be urgent: (1) Minute explanations, on pathological grounds, of the adenoid growths in the region of the third tonsil, such as have been known to be removed *ad infinitum* by specialists. No microscopic evidence of bacilli is found either in the flesh removed or in the patient's expectoration and yet the patient goes on to die of laryngeal tuberculosis, as the gradually increasing peribronchial and apical infiltration and consolidation, immediately following the surgical interference in the throat, indicated. Such a case is just now very distinct in my memory, and will recur to the mind of the distinguished physician who kindly recommended the case to me, but very unkindly, and I think unwisely, prevented my afterwards using tuberculin in the case, the only means I know of which would have compassed a cure, however incomplete that would have been. The prejudice in the minds of some of our best

physicians against even the advanced and enlightened use of tuberculin is as unreasonable as it is alarming. (2) An understanding of the absence of tubercle bacilli, or their tardy and very infrequent appearance, compared with the amount of glandular growth, in so-called scrofulous glands, with or without a coincident active tubercular process in some part of the body. (3) An understanding of the growth of tubercles, the "nodules" which have come down to us, previous to the discovery of the bacillus, as the essential feature of phthisis. As elsewhere explained in the essay on tuberculin, etc., previously referred to, I have myself a strong belief that these are the natural prison vaults built for the encapsulation of the tubercle bacilli, in which condition the germs, if not strangulated, are held so much in quiescence that they are incapable of propagation or further harm. This is a condition of arrest while it lasts, while the natural resistance of the system is maintained, which is perhaps about all nature can do in the direction of a cure. But the natural effort to maintain the integrity of the living cell is all the time active, and its mention here is made solely with the hope that some more worthy investigator will by its means, i. e., on natural grounds, elucidate for the medical profession the intricate problems here suggested.

PRACTICAL MEASURES IN THE PREVENTION OF TUBERCULOSIS.

By LAWRENCE F. FLICK, M. D., of Philadelphia, Pa.

The history of tuberculosis in all times and in all countries in which any history of it is recorded is a broad demonstration of its contagiousness and, by inference, of its preventability. So insiduous, however, is its contagiousness, that although it has been recognized by the greatest minds of every age and has at times taken strong enough hold of the lay as well as of the medical mind to beget successful measures of prevention, at no time in the history of medicine prior to the present age had it been recognized and understood by the medical profession as a body. The contagious theory of tuberculosis is now so far accepted by the profession that it is being taught in our medical schools; so that the medical profession is committed to it at least through its teaching faculty. The prevention of the disease has, moreover, had sufficient practical testing to remove it from the category of experiments and place it upon the list of sanitary expedients deserving of the most earnest attention of sanitarians. Spain, by teaching its people the contagious nature of consumption and by practicing crude and unscientific but nevertheless successful methods of prevention, avoided carrying the disease into its new colonies in America; Italy, by similar methods, reduced the mortality rate from the disease in its midst from that of a most virulent epidemic to a comparatively rare disease in less than a century; England, by establishing special hospitals for the treatment of consumption and the consequent isolation of its consumptive poor, reduced its mortality 50 per cent in forty years; and Philadelphia, by preaching the doctrine of contagion and teaching its people methods of avoidance and prevention, has reduced the mortality rate from the disease about 20 per cent in eight years. With these facts before us, and with our profession committed to the theory of contagion, we can not, without failing in our duty, remain inactive while this disease carries off hundreds of thousands of human beings to a premature grave and inflicts indescribable suffering and loss upon hundreds of thousands of others. A comprehensive scheme for the prevention of tuberculosis implies: (1) Registration of all cases of the disease which have arrived at the breaking down or infectious stage; (2) the education of the public at large and of the people immediately concerned as to the contagious nature of the disease, and upon how to avoid contracting it, and how to avoid giving it to others; (3) the careful and thorough disinfection of all infected houses, penal and

reformatory institutions, conveyances, and public places; (4) the establishment of special hospitals for the treatment of the poor suffering from the disease; (5) the retirement of all consumptives in the infectious stage from occupations in which they can infect others and the pensioning of those who can not be maintained in hospitals; (6) Government inspection and regulation of dairies and slaughter-houses; (7) the enactment of laws and ordinances against practices which are liable to infect others; (8) the restriction and regulation of interstate and international emigration of persons suffering from the disease. The enforcement of such a scheme in every particular would completely wipe out tuberculosis in a very few years. Of this there can be no doubt, whether our conclusions be evolved from our present knowledge of the etiology of the disease or from what history records of the past attempts at prevention. As regards the respective merits of the measures named there will probably be a difference of opinion. I have enumerated them partly in the order of their importance as I rate them and partly in their natural order of sequence. The feasibility of their enforcement necessarily varies, and ought to determine which shall be adopted when all can not be adopted. At the present stage of sanitary science, and as Governments are now equipped for the prevention of disease, there is probably no country in which the entire scheme could be put into operation; nor is it likely that any Government is at present in a position to thoroughly enforce any of the measures. The prevention of tuberculosis is, however, so easily accomplished that even the incomplete enforcement of some of the measures would bring about a marked reduction in the mortality from the disease.

(1) *Registration of all cases which have arrived at the breaking-down or infectious stage.*—Registration is necessarily the foundation stone of all orderly, systematic effort at prevention. To be able to fight an enemy one must first know where he is. Even individual effort at self-protection is futile without it. Registration should not only record the residence, but also the movements of infectious persons, such as removals from one house to another or from one city to another; for a temporary residence in a house or even a transitory occupancy of a conveyance may infect it sufficiently to convey the disease to others. One consumptive, by frequent change of residence, may infect many houses during the continuance of the disease. Registration will be objected to on the ground that it will impose additional suffering upon those who are already sorely afflicted. In a matter of such great importance to the well-being of the majority of those now living and of all of those yet to be born, the greatest good to the largest number ought to be our motto. Moreover, the registration of infectious cases of tuberculosis need inflict no suffering on anyone that would not be fully compensated for by a knowledge that the near and dear ones can thereby be protected against the disease. Objections based upon commercial grounds have no foundation in fact. People are too familiar with consumption to take fright at it even when they believe it to be contagious. The registration of cases would have no depressing effect upon the community as a body, and whatever care-inspiring influence it might have upon individuals would be a benefit. Private business might, in certain cases, be injured because people would not buy at a place attended by a consumptive; but this would be a benefit to the community, and the individual concerned could easily rid himself of the injury by removing the attendant from a position in which he jeopardizes the health of others. Interference with the value of real estate would be prevented by Government disinfection of infected houses. As most countries are now equipped for carrying out sanitary measures registration would have to be accomplished through boards of health with the aid of practicing physicians. This is already being done with such diseases as smallpox, scarlet fever, typhoid fever, diphtheria, and some other contagious diseases. Many physicians object to being burdened with the labor of making out reports and to being

placed in the embarrassing position of having to make public the ailments of their patients. But with properly prepared blanks for the making out of reports it can be termed neither a labor nor a burden, and could easily be attended to by the busiest practitioner. As regards the making public the ailments of patients, it is under the circumstances not only a privileged communication, but one which the public has a right to insist shall be made. The physician has no reason to complain of such duties, because they belong to the profession which he has espoused. There can be no practical difficulty in the way of registering tuberculosis because of the obscurity of the disease or inability on the part of the physician to make a diagnosis. Tuberculosis is never contagious until broken tissue is given off, and when this occurs a diagnosis can always be positively made. There is no occasion for making a report until this stage has been reached.

(2) *The education of the public at large and of the people immediately concerned as to the contagious nature of the disease, and upon how to avoid contracting it, and how to avoid giving it to others.*—Of all contagious diseases the most easily prevented is tuberculosis. Its contagion is strictly confined to broken-down tissue, and this broken-down tissue, when given off, is readily recognizable—is indeed apt to attract attention. Efficient sterilization of all broken-down tissue must absolutely prevent the spread of the disease, and as this tissue is always within reach when it is a source of danger to others, and is never a source of danger to others unless it is within reach, sterilization is always feasible and is within the power of everyone. The proper education upon this subject of the public and the people who either have tuberculosis or are exposed to it would go a long way toward preventing the disease. The public at large ought to be educated upon the question of contagion. This can best be done through the public press, which has already accomplished a great deal in this direction. The people who have consumption ought to be taught how to avoid giving it to others, and the people who nurse consumptives or whose duties require them to be about those who have the disease should be taught how to avoid contracting it. Special literature ought to be prepared for such persons and placed within their reach. This can be accomplished through boards of health, and better still through the organized efforts of humane persons who have given the subject special thought. Societies for the prevention of tuberculosis will find in this work not only a legitimate cause for springing into existence, but a field of labor worthy of their most earnest efforts. Such societies ought to be organized everywhere, and a concerted effort should be made the world over to educate the people on methods of avoidance and prevention. The Pennsylvania Society for the Prevention of Tuberculosis was organized in Philadelphia about two years ago, and during its brief existence has printed and distributed about 30,000 tracts on How to Avoid Contracting Tuberculosis and How Persons Suffering from Tuberculosis can Avoid Giving the Disease to Others. There is reason to believe that its efforts are already bearing good fruit in an increased reduction in the mortality rate from the disease in Philadelphia. The greatest obstacle in the way of performing its work has been non-registration of the disease. Were every case of tuberculosis registered it would be an easy matter to place literature where it would do the most good.

(3) *The careful and thorough disinfection of all infected houses, penal and reformatory institutions, conveyances, and public places.*—Were it possible to induce every person suffering from tuberculosis to sterilize every particle of broken-down tubercular tissue immediately upon its being given off it would not be necessary to institute any other measures for the prevention of the disease. Unfortunately, it is not possible. The majority of consumptives, even when they have been informed of the infectious character of the sputa, will spit where it is most convenient, and thus contaminate everything about them. Infected houses play a most important rôle in the spread of the disease. In my topographical study of tuberculosis in the

Fifth ward of the city of Philadelphia I found that at least 50 per cent of all cases were contracted in such houses. Dr. Chapin, of Springfield, Mass., and Dr. Louis S. De Forrest, of New Haven, Conn., have since made similar studies in their respective towns with identically the same results. Dr. Cornet, of Berlin, has produced tuberculosis in animals by inoculating them with the scrapings from walls of rooms which had been occupied by consumptives. Penal and reformatory institutions have been so scourged by tuberculosis that commitment to them is frequently tantamount to a death sentence. In Germany, Baer and Cornet have made statistical studies of this subject, and have found that from 45 to 70 per cent of all deaths in penal institutions are due to tuberculosis. Conveyances, such as steamboats, railway cars, street cars, carriages, etc., and public places, such as churches, public halls, public squares, and streets, are constantly being contaminated with the expectorations of consumptives. Fortunately, however, they are not prolific sources of infection, because most people require prolonged and continuous exposure to contract tuberculosis. But persons who are greatly predisposed to the disease or who are in a weakened, depressed condition will contract the disease upon slight exposure and to such, infected conveyances and public places are a real source of danger. With the clear knowledge that we have upon these various methods of spreading the disease it is incumbent on the Government to see that every place which has become contaminated with broken-down tubercular tissue be carefully disinfected. When a death from tuberculosis has occurred in a house the board of health should see that the rooms occupied by the deceased and the furniture and clothing which could in any way have been contaminated be properly disinfected. When a house has been disinfected it should be so recorded in an open record of easy access to the public, so that persons seeking residences can first inform themselves as to whether or not a house is free from contagion. In penal and reformatory institutions every cell or room which has been occupied by a consumptive should be thoroughly disinfected before being assigned to a new occupant. Here the authorities have absolute power, and there ought to be no difficulty about enforcing the most rigid rules in regard to prevention and securing the most thorough disinfection after contamination. The disinfection of conveyances and public places will have to be left largely to the sense of justice and propriety of those who have charge of them, as it is practically impossible to make and enforce rules covering such cases. Much can, no doubt, be accomplished by education. Most people are well disposed to do what they can to prevent the spread of disease, provided they have the proper knowledge and the necessary means. The demands of an enlightened public will probably be the most powerful lever that can be brought to play upon both individuals and corporations who have charge of any and all kinds of conveyances and places of public resort to induce them to keep them free from contagion.

(4) *The establishment of special hospitals for the treatment of those suffering from the disease.*—Among the very poor, preventive measures in their homes are so difficult of execution that they are practically impossible. Families who can barely make a living during health, and of which every member has to contribute toward a common fund for sustenance, are so badly upset by a prolonged illness such as tuberculosis that they are not capable of either understanding or putting into operation any systematic sanitary measure. Everything is made subservient to the happiness, comfort, and freedom from worriment of the sick one. The room that serves as the family kitchen and dining room is turned into a sick room, and spitting all over it, into the coal scuttle or into the front of the cooking stove, anywhere, indeed, that is convenient, is a privilege that is freely accorded. Such habits in such places mean extension of the disease to the weakest member of the family until, in turn, everyone has taken on the rôle of victim and propagator of the disease. Among this class of people the most efficient measure for

the prevention of the disease is the establishment of special hospitals for the treatment of those who are stricken down. Removal of the patient to a hospital removes the source of infection and at the same time relieves the pressure of worry, want, and care which is so strongly predisposing the remaining members of the family for the disease. Special hospitals for the treatment of tuberculosis have existed in Europe, and especially in England, for many years. In England the motive for their establishment was not prevention, but extending charity to the deserving poor. Now that it has been demonstrated that segregation will prevent the disease, and we still have the inspiring motive that England had, we ought to move more rapidly in the matter than is possible on the slow wheels of charity. While every effort to establish special hospitals on the basis of charitable support should be encouraged by generous aid, the Government should promptly establish such hospitals on its own account. The only legitimate ground upon which the Government can appropriate money for the support of hospitals is that of protecting the public against disease and death. In as much as tuberculosis has been demonstrated to be a preventable disease, and it has been proven by experience that segregation will prevent it, the establishment of consumption hospitals becomes as much a Government function as the maintenance of a police force. The truth of this proposition must sooner or later force itself upon every enlightened Government. In considering the matter of special hospitals for the treatment of tuberculosis as a preventive measure the question of forcible segregation, with its horrible features, need not have any deterring influence. In the first place, there is no necessity for it. Were hospital doors thrown open for such cases there would be more applicants for admission than could be accommodated. With all its present capacity, which is very large indeed, England can not accommodate the poor consumptives who appeal for admission into its special hospitals. In the next place, an alternative can always be given without jeopardizing public health. In a given case of tuberculosis in which the question of forcible segregation might come up, the sick person and the family could be given a choice to either have the patient go to a hospital or practice certain preventive measures at home. Such measures could then be enforced by the board of health, as there would be a penalty at hand to support the order. In our American system of government the taxation for the support of such hospitals ought to be as direct as possible, and for this reason they ought to be established and maintained largely by cities and States. Every large city should have such hospitals under the supervision and support of the city government, and every State should have at least one such hospital under its supervision. It would be a step in the right direction of judicious bestowal of charity if some of the general hospitals of our large cities would take up this subject and devote themselves entirely to the care of the consumptive poor. It is a well-known fact that the unfortunate victims of this disease are turned away from general hospitals because of the disease from which they suffer. As general hospitals have grown so numerous of late that there is at times a lively competition for patients, it would no doubt prove a wise deviation from the beaten path for some of them to take up this specialty.

(5) *Government inspection and regulation of dairies and slaughter-houses.*—Ever since it became known that tuberculosis affects animals as well as man, and that it is identically the same disease in both, there has been much speculation as to which was attacked first, and what part they respectively play in infecting each other. Some who have given the subject much thought and study, and notably among them Dr. E. F. Brush, of Mount Vernon, N. Y., claim that the disease is primarily a bovine disease, and that human beings and animals other than the cow are infected from this source. I have myself never been able to accept this theory, but whether we accept it or not so much is certain that human beings and domestic animals can and constantly are infecting each other. The mediums

through which the cow infects human beings are milk and meat. Much study has been given to this subject both in this country and in Europe, and we now have a pretty clear idea as to what constitutes infectious milk and meat. The milk of a tuberculous cow is not apt to be infectious unless the udders are diseased so that the secretion becomes mixed with broken-down tubercular tissue. At all events it is necessary that the bacilli gain entrance into the milk to make it capable of conveying the disease. The meat of a tuberculous animal is only infectious when the deposit exists in the parts that are consumed or when those parts have become contaminated in slaughtering and preparing for the market. It is important that these facts be kept clearly in mind because of the important positions which meat and milk occupy as food stuffs, and the great injury that can be done by exaggerating the danger from using them. Clinically we have very little evidence of the conveyance of the disease through these mediums. I have never seen an authenticated case recorded in literature, and personally I have never seen a case which I could trace to the use of meat, and have seen but a few cases in which there was satisfactory evidence that they were contracted from the use of milk. But while scientific investigations and clinical observations both point to the conclusion that in practical life the use of milk and meat are not prolific sources of infection of tuberculosis it nevertheless can not be denied that they are sources of sufficient importance to demand the most earnest attention of the Government. An effort should be made to stamp out tuberculosis among cattle. To accomplish this the coöperation of Federal, State, and city governments will be needed. The Federal Government should prohibit and prevent the importation of tuberculous cattle. State governments should carefully examine every herd within their borders, and condemn every head that is in the slightest degree affected by the disease. Cities should condemn and forbid the sale of every carcass that shows the slightest evidence of taint in the slaughter-house, and permit no one to sell milk within its limits except such as draw their supply from dairies of which the herds have been officially examined. Such concerted effort would soon stamp out the disease among cattle, for it would no longer be commercially profitable to keep anything but healthy herds. Actual loss to individuals ought, of course, to be made good by the Government.

(6) *The enactment of laws and ordinances against practices which are liable to infect others.*--Civilized man, in spite of his civilization, retains many of his primitive habits. Among these is the horrible custom of spitting anywhere and everywhere that is convenient. There are a great many diseases the contagion of which resides in expectoration, all of which put people to a great deal of inconvenience, but none of which are so serious in their results as tuberculosis. How much would be added to the comfort and happiness of the human family were it possible to put a stop to this filthy custom. The promulgation of knowledge about the danger of promiscuous spitting would no doubt contribute something toward breaking up the custom. It is, however, so much easier and more convenient to spit out than into a cuspidor or handkerchief, that with the majority of people it will require more than education to induce them to change their habits in this regard. The necessity of washing handkerchiefs no doubt contributes something toward the custom and its continuance after people know the danger. The introduction of cheap paper handkerchiefs which could be burned after using would do away with this excuse for the habit. The enactment of State laws and city and borough ordinances against spitting in public conveyances, in public places, or upon the streets would, however, be the most powerful lever that could be brought to bear upon the custom with the masses. It would be difficult to enforce such laws and ordinances, and they probably could not be enforced to the letter. Their existence and attempted enforcement would, however, do much good, even as a means of education. Many street-car companies now have notices up in the cars warn-

ing passengers not to spit upon the floor, but they do not attempt to enforce the order, probably because they have no warrant of law to support them should the matter be brought to an issue. The disposal of clothing and furniture either by gift or sale without previous disinfection is another practice fraught with great danger. The Spaniards and Italians recognized this source of infection a century ago, and took the most careful precautions against it. Their method was cumbersome and would not do as a model, but it was effective, and serves to illustrate what can be accomplished by a determined effort. The simplest way of stopping this mode of spreading the disease would be to make it a misdemeanor to dispose of anything, whether by sale or gift, that had been used by a consumptive or had been in his room during his occupancy, without first thoroughly disinfecting it. Here again would of course come up the difficulty of enforcing the law, but the existence of such a law would at least enable individuals to protect themselves.

(7) *The restriction and regulation of interstate and international emigration of persons suffering from the disease.*—History teaches that one of the most potent factors in the spread of tuberculosis has been the migrations of consumptives. The will-o'-the-wisp of a climate which would cure consumption has been indirectly the means of infecting the world. There is scarcely a country which has not at one time been free from the disease and for that reason become a resort for those suffering from it. In turn the place became a place of exodus and a source of infection to some newer country. All of America was virgin soil for the disease when Europeans came here. New York, Pennsylvania, in fact every State and Territory, has in turn been a resort for the consumptive and was at one time believed to possess a curative climate. Unfortunately this seductive method of spreading the disease is still in active operation, and with our modern facilities for travel has become more prolific than ever. It probably furnishes the most frequent source of infection to the wealthier class, those who can change their place of abode with every change of season. It infects our hotels, our sleeping cars, and our staterooms. It has made tuberculosis as rampant under the sunny sky of California as in the changeable climate of the Atlantic Slope. What is the remedy? International emigration of persons suffering from tuberculosis should be entirely stopped. This is a matter for the Federal Government, and in the United States is, I believe, through the efforts of Surg. Gen. Wyman, already receiving attention. Foreign travel of persons in the early stage of the disease before there is any breaking down need not be interfered with. Interstate emigration should be restricted and regulated. This would of course be a matter for the States and in certain cases for cities to take charge of. Persons in the infectious stage of the disease should be discouraged as much as possible from changing their places of residence, and when they do make changes it should be with the consent and under the supervision of the health officer. Some of the Territories and newer States which are as yet comparatively free from tuberculosis would probably find it to their advantage to shut out from their borders all consumptives in the infectious stage who seek admission for climatic reasons. Such an embargo would of course not need to be applied to those in whom the disease has not yet reached the breaking-down stage, and to those that have, it would be more of a benefit than an injury as they can no longer be saved by a change of climate and are frequently seriously injured by it.

(8) *The retirement of all consumptives in the infectious stage from occupations in which they can infect others, and the pensioning of those who are dependent on their own labor for a living and who can not be maintained in hospitals.*—Because of the prolonged duration of tuberculosis it is necessary for the poor to follow their callings in life during the infectious period of the disease. We consequently have consumptives for cooks, waiters, barbers, fruiterers, grocers, butchers, dairy-

men, nurses; in short, we have them in every walk of life. To ask these people to give up their positions is a great hardship unless some provision is made for their support and that of the destitute families depending upon them. As the giving up of their positions would be in the interest of the public good, they ought to be retired at public expense. Every case of tuberculosis which has arrived at the infectious stage ought to be retired from any position where it could infect others, and either be given admission into a hospital or paid a pension sufficient for maintenance. For the destitute family depending upon the labor of the person affected there would be ample provision in the eleemosynary institutions already in existence. Retiring and pensioning persons suffering from a disease which is a menace to others will no doubt be considered too advanced ground in preventive medicine to be considered seriously at present. It will, however, force itself upon our attention in the near future. The justness of the principle involved has already been admitted in the compensation allowed for diseased cattle slaughtered by direction of the Government. By the establishment of special hospitals for the treatment of persons suffering from consumption, the consumptive poor of the country could be maintained at a quite reasonable expense. The taxation which would have to be imposed upon the individual to enable the Government to carry out such a plan would be returned an hundredfold in the protection afforded against the disease. Tuberculosis carries off at least 100,000 people annually in the United States. It has been estimated that this entails a loss in public wealth of about $500,000,000 a year. A small fraction of this great loss well expended would go a long way toward wiping out the disease.

THE CLIMATE OF WESTERN NORTH CAROLINA, WITH A CONSIDERATION OF THE RELATIVE VALUES OF HIGH AND MEDIUM ALTITUDES IN THE TREATMENT OF PULMONARY TUBERCULOSIS.

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In speaking of North Carolina, and especially its mountainous part in the western portion of the State, which is already widely and favorably known on account of its climate, I shall necessarily have to repeat what I have stated elsewhere at various times and occasions, and what has been stated by others before my time. That part of western North Carolina known as the Asheville plateau has, in the parlance of climatologists, only a medium elevation of some 2,500 feet above sea level. There are, however, within a radius of 30 miles of Asheville and encircling the plateau, both higher and lower levels, and within a few hours' journey we can reach elevations varying from 1,200 to nearly 7,000 feet. If it should appear desirable these elevations can be made use of in the climatic treatment of phthisis and other diseases. Some writers, and especially such as practice at much greater elevations than that of the Asheville plateau, convey to us the impression that only the higher levels are really curative in the climatic treatment of phthisis, and that such levels as the one to which I am now calling your attention are a sort of medium, "neither good nor bad." They therefore almost deny to the medium and lower level resorts the right of existence, as being of use only as a makeshift at best, whereby the chances for the patients' ultimate recovery are liable to be trifled away. If this view is really warranted by the facts, a prompt recognition of it by all who have occasion to send away phthisical patients for climatic treatment would be most desirable. The inconsistency of the position is, however, manifest, apart from the fact that clinical experience disproves the assertion. If elevation is beneficial at all, and no one experienced in phthiso-therapy denies that, the most

that could be claimed theoretically would be that it is relatively so, according to the degree obtained, for it would be strange indeed that 2,500 feet should count for nothing, whereas 6,930 feet are auspicious. I hope, however, to show you that a golden mean is not to be ignored any more in this than in many other of our endeavors, and that, other things being equal, a medium elevation presents advantages over high levels like Colorado and other portions of the Rocky Mountain system by which we find ourselves clearly the gainers. At a medium elevation of from 2,000 to 3,000 feet, like the one of the Asheville plateau, the heart action is not disturbed to such a degree as is the case at elevations much higher and, while the influence of the change is perceptible at lower levels also, patients do not suffer on account of shortness of breath and palpitation of the heart so frequently complained of by consumptives in going to high altitudes. The shortness of breath is in part induced by the rarefied atmosphere, of which a proportionally larger volume is required to convey to the blood an adequate amount of oxygen. In health this is to a degree compensated by deeper respiration, but the patient who has his respiratory capacity perceptibly decreased on account of the changes which have occurred in the lung can make up the deficiency for the most part only by increased frequency, or not at all if the elevation has reached a considerable degree. To this comes the additional disadvantage that the degree of possible lung expansion is less in proportion as we decrease the atmospheric pressure, which was demonstrated as long ago as 1850 by Pravaz, and subsequently by Lange and others; and I have recently repeated their experiments, both under increased and decreased atmospheric pressure in the pneumatic cabinet. I find, as they did, that if under ordinary air pressure a healthy person performs complete expiration and thereupon attempts forcible inspiration through a tube connected with a mercury manometer the mercury is raised 4½ to 5 cubic centimeters. If now the air chamber is closed and the pressure in it increased, upon a repetition of the experiment the mercury rises higher in proportion to the increased pressure. If the pressure in the chamber is diminished the result is reversed and lesser values are obtained than under ordinary pressure, corresponding again to the degree of rarefaction. By practice higher values are obtained in either case, but the relation of the rise of the mercury in the manometer to pressure and rarefaction remains constant. The same experiments carried out with patients suffering from pulmonary tuberculosis showed identical results, but it was noted that the inspiratory and expiratory forces were always below the normal, and even in cases in comparatively early stages a diminution of 15 to 25 per cent was the rule. It is therefore erroneous to believe that the respiratory capacity of the lungs is greater under diminished air pressure. On the contrary, it is proportionally less, as is also the degree of oxygenation of the blood, which is dependent upon it and upon the density of the atmosphere. If, in addition, we observe the effects of greatly diminished air pressure upon the circulation of the phthisical patients, and especially of such as have advanced beyond the very early stages, we find that it is not borne as well as it is in the cases of persons having no lung disease, while in all cases the peripheral circulation is increased as the surface pressure is diminished. In health the veins can empty themselves freely into the right auricle and ventricle, whence under increased frequency of respiration, with unobstructed lung tissue, the flow through the pulmonic system to the left heart is equally free, and in this manner an equilibrium between the greater and lesser circulation is maintained. If, however, the lung can not fully expand from the too great rarefaction of the air, and if the lung suffers in addition in its expansion by the presence of pleuritic adhesions, thickening, or exudates, or if the parenchyma of the lung is itself the seat of inflammatory changes, infiltrations, or consolidations, then there is a mechanical obstruction placed in the lung to the free flow of blood from the right ventricle through the lung to the left auricle, and the equilibrium between the

lesser pulmonic and the greater systemic circulation is easily disturbed or lost. The heart is now called upon to compensate the disturbance by increased power and frequency of contraction, and under rest, or with a strong heart muscle, when the obstruction is not too formidable, this equilibrium may be obtained or reëstablished. If the conditions for perfect equalization of the circulation are not present, then passive pulmonary congestion and heart strain are the inevitable results. In some cases, at great elevations, this can be only avoided by absolute rest in the recumbent position, while with others it is impossible under all circumstances, and the patient, unless quickly removed to a lower level, soon dies, either from pulmonary hæmorrhage, edema, or heart failure. In still others the congestion leads to renewed or increased active, possibly destructive, changes and their consequences, and in all this equalization of circulation is more readily disturbed by comparatively slight causes, which at lower levels are inoperative. The greater the elevation the greater is the liability for these undesirable effects. At high altitudes much less exercise is therefore possible without resulting in pulmonary congestion and heart fatigue—conditions which cause shipwreck in the journey for health of the consumptive more frequently than all other preventable causes combined.

Consumptives are more liable than others to pulmonary congestion and heart fatigue at any level, first, because of the obstruction to the circulation produced by the lung disease, and second, because of the accompanying nutritive disturbances and anæmia. The heart in most cases is already damaged, weak, and irritable and seldom in a condition which justifies us to make great or unusual demands upon it, and this is often true even in the early stages of the disease. It follows, therefore, that we can not employ altitude in the treatment of phthisis on the principle that "the greater the elevation, the better for the patient," and I find from practical experience that even at a medium elevation of 2,350 feet the tendency to heart fatigue is more manifest than I have found it to be at places with lower elevations. I have thus had occasion to advise the removal of patients to lower levels because of circulatory disturbances, in the absence of actual heart disease, which were unquestionably due to the reduced atmospheric pressure, inasmuch as they did not exist before leaving home, and promptly subsided when my advice was complied with. Any unusual demand upon the heart, be that on account of change in the atmospheric pressure, physical exercise and labor, or other strain, must therefore have our careful consideration and be avoided unless in cases where we are reasonably sure that the heart is adequate to the demand and that our patient will be benefited thereby. The liability of consumptives to heart strain with its consequences exists also when going from high altitudes to considerably lower levels and, other things being equal, the effects are in proportion to the degree of change in the atmospheric pressure and the rapidity with which the change is made. At a medium elevation these effects are better borne, because the strain is less and patients still in a condition where improvement and cure can reasonably be looked for can come to and return from lower levels with greater safety.

The danger to patients of returning to seacoast localities who were considered cured at the high elevations of Colorado and New Mexico is recognized even by the laity and physicians both at the elevated stations and at home recognize the fact by advising against it, so that it practically means exile from home and friends and from former associations for life to send consumptives to very high elevations, to say nothing of the dangers and disadvantages to which they would be thereby exposed. If it were true that by these means only a relative cure can be accomplished, the sacrifice and risk would be imperative, although regrettable. There are still other disadvantages of high-level resorts, among which I may mention the great ranges of temperature. Extremes, not only in altitude but also in

temperature, are undesirable for the consumptive. If he is to live out of doors as much as possible he must avoid great degrees of cold, against which he finds it difficult to protect himself, especially when not taking active exercise, and against the enervating extremes of heat he can not protect himself at all. With these extremes occur great and sudden variations in temperature, and these the consumptive feels to his detriment in any stage of the disease.

According to Dr. J. W. Gleitsmann, who made temperature comparisons between some high altitude resorts of Colorado and the medium elevation of Asheville, N. C., in 1874, a temperature of 90° F., with a maximum of 102° F., occurred in Denver, Colo., fifty times, and at Colorado Springs thirty-nine times during the same summer, when in Asheville, N. C., only once a temperature as high as 88° F. was observed. He also found similar, only reversed, extremes for the winter months, during which, owing to its geographical position and lower altitude, the Asheville plateau, with an average of 46 F. for the winter months, is free from severe cold weather; snow rarely falls, and when it does the sun usually melts it away on the same day. That a happy medium is best is also true as to a "comparatively dry climate," which constitutes another desirable factor in the climatic treatment of phthisis. Too great dryness of the air is, however, undesirable, becoming frequently a source of irritation to the lungs and throat, and Dr. Rudi, of Denver, recognizing the disadvantage, advises the generation of steam in the patient's sleeping apartment.

Great dryness of the air is associated with prolonged dry spells and the absence of rain, which means a large amount of dust floating in the air, the inhalation of which should be avoided in all lung and throat affections. At lower levels the air contains relatively more moisture, and upon the Asheville plateau the average humidity for the entire year is 65 per cent, while at some points in Colorado and New Mexico it is no doubt much lower. Sixty-five per cent is, however, relatively dry, and compares favorably with the lowlands, where the average is in the neighborhood of 80 per cent. The number of clear and fair days at a given climatic resort is also important, as upon them depends largely the patients' ability to derive the full benefit of climatic treatment in living out of doors as much as possible. Many of the localities with medium or lower elevations can compare in this respect with the higher levels, and the Asheville plateau has averaged twenty-five clear and fair days for each month in the five years since the establishment of the U. S. Weather Bureau in 1888. In the past year there have not been more than three or four days on which my patients did not have the advantage of out-of-door life on account of unfavorable weather. The Asheville plateau can therefore claim freedom from all extremes in elevation, temperature, or humidity; it has every condition favorable to out-of-door life; it is an all-year favorable locality where in the residence of the invalid no change is required with change of season.[1] It is easily accessible, being within twelve to twenty-four hours' travel of the Eastern, Middle, and Southern States, obviating the more serious and frequently detrimental fatigue from days of travel to localities of greater elevation and greater distance. That such resorts of medium elevation deserve consideration is apparent from the estimation in which they are held by the profession, and much lower levels than the Asheville plateau have shown excellent records in improvements and recoveries obtained, and the facts presented regarding the disadvantages of high altitudes outweigh in my judgment any supposed advantage claimed for them; but apart from the foregoing considerations we must consider as our best guide the clinical results obtained and compare them.

Speaking for western North Carolina, and the Asheville plateau in particular, I am able to record equally as good results, if not better, as have ever been shown

[1] For more particulars reference is made to the meteorological table from the records of the U. S. Weather Bureau for the years 1888 to 1892, attached at the end of this paper.

for the high-level resorts, and, without going into details, I can say that in the truly early stage I have for several years past obtained 100 per cent of recoveries in all cases who remained a sufficient length of time to justify the expectation, while not a single early-stage case has failed to show improvement from even a comparatively short season of residence. The high-level resorts can not possibly do better, and with these results the plea for more than medium elevation must fall to the ground. I have now records of 518 cases treated and discharged more than two years and as long as five years ago. The permanency of the results in these cases was inquired into this past winter by correspondence with patients, their relatives, or their physicians. With but few exceptions, they have all returned to their previous places of residence and the answers received show that a cure or permanent arrestment of the disease continues in 181, or 35 per cent; 296 others, or 56 per cent, continue still improved as compared with the time of their arrival at Asheville; and only 70 patients have grown worse or have died. Not until better results and of equal duration can be shown for the high-altitude resorts need the profession seriously consider any possible advantage they may claim over lower or medium levels.

In conclusion, I desire to say that I am not unmindful of excellent results obtained in high altitudes, especially in the early stage, nor of the fact that the statistics of the high-level resorts are seriously clouded by the unfavorable course and bad results in cases at all advanced in the disease and who were erroneously sent to them. I claim, however, that such early-stage cases could have derived the same benefits at lower levels without subjecting them to the dangers pointed out in the earlier part of this paper, and that many of the advanced cases who fail to improve or grow worse at high altitudes could derive benefit at places having only a medium elevation.

Summary of meteorological records for the years from 1888 to 1892, inclusive.

[The United States Weather Bureau meteorological observatory at the Winyah Sanitarium, Asheville, N. C. Elevation, 2,350 feet; Lat., 35° 36′ N.; Long., 82° 26′ W. Hours of observation, 7 a. m., 2 p. m., and 9 p. m.]

Years.	Season.	Mean temperature.	Mean maximum temperature.	Mean minimum temperature.	Absolute maximum temperature.	Absolute minimum temperature.	Mean daily range of temperature.	Mean daily variation of temperature.	Mean relative humidity.	Mean absolute humidity in grains of moisture per cubic foot of air.
1888–'89	Winter	44.46	55.35	35.46	69.50	20.20	19.73	2.45	60.12	2.177
1889–'90	do	48.68	59.30	37.93	74.30	18.50	21.33	2.80	64.60	2.585
1890–'91	do	45.18	55.56	72.68	63.33	17.98	20.23	2.85	63.40	3.771
1891–'92	do	44.83	55.11	33.73	60.40	16.16	21.37	2.65	64.78	2.009
Totals		183.15	225.32	179.80	269.53	72.84	82.66	10.75	252.90	10.532
Means for four years.	Winters	45.79	56.44	44.95	67.38	18.21	20.66	2.69	63.22	2.633
1889	Summer	64.97	75.83	54.33	85.20	39.50	21.33	3.	70.98	4.380
1890	do	65.24	76.	56.25	85.63	45.20	19.73	2.70	71.	4.290
1891	do	65.19	76.59	54.57	86.60	43.	23.	2.60	68.06	4.230
1892	do	67.68	78.63	57.45	88.40	46.60	21.	2.80	71.37	1.640
Totals		263.58	307.05	222.60	345.93	174.30	85.16	11.10	281.41	14.520
Means for four years.	Summers	65.89	76.76	55.65	86.48	43.30	21.24	2.77	70.35	3.630

Summary of meteorological records, etc.—Continued.

Years.	Season.	Mean number of clear and fair days per month.	Number cloudy, and rainy days per season.	Mean number days without sunshine per month.	Mean number of days on which $\frac{1}{100}$ inch or more of rain fell per month.	Mean per cent of ozone of possible amount per month.	Mean barometer corrected for temperature and altitude.	Mean amount of rainfall, in inches, per month.	Direction of prevailing winds.	Mean force of wind, scale 0 to 6.
1888–'89	Winter	24.3	6.3	1	11.5	51.	30.13	4.36	N.	2.12
1889–'90	do	27.6	3.	2	13.3	40.20	30.15	4.29	N.	2.44
1890–'91	do	25.	6.	0	11.6	56.	30.14	4.23	N.	1.80
1891–'92	do	25.	6.	1	11.	55.10	30.13	1.64	NW.	1.45
Totals		101.9	21.3	4	47.4	202.30	120.53	14.52		7.91
Means for four years.	Winters	25.4	5.3	1	11.8	50.57	30.13	3.63	N.	1.98
1889	Summer	24.5	5.3	1	6.5		30.18	2.09	NW.	1.39
1890	do	24.6	5.5	0	9.6	49.40	30.25	3.12	NW.	1.41
1891	do	25.5	8.9	1	11.1	44.22	30.18	3.94	NW.	0.80
1892	do	20.	10.	0	9.5	53.42	30.02	3.98	NW.	1.
Totals		94.6	29.7	2	36.7	147.04	120.63	13.13		4.50
Means for four years.	Summers	23.6	7.4	½	7.4	49.	30.15	3.28	NW.	1.12

OBSERVATIONS ON THE CONVENIENCE OF ESTABLISHING A UNIFORM AMERICAN INTERNATIONAL SYSTEM OF QUARANTINE AND MARITIME HYGIENE.

By JUAN J. ULLOA, G. of San José, Costa Rica, Central America.

My first intention was to deliver my short essay in Spanish, because, it being my own language, I can express myself better in it than in yours. But as the English-speaking doctors constitute the great majority I will try to make myself understood in English. Without any pretension on my part of saying anything new, I simply wish to excite my illustrious companions to the discussion of a topic which in my humble opinion is of the utmost importance to all the nations which compose the occidental hemisphere.

I do not consider it worth while to refer to the interest with which the entire civilized world treats all questions appertaining to hygiene in its manifold applications, convinced as they are of the importance of the branch whose principal object is to look for the causes of disease and to endeavor to find the best manner of destroying them, or at least of diminishing their deleterious influence on the health and well-being of the human race. In all nations which march forward with the century and which keep abreast of modern science hygiene receives the greatest attention, and in consequence its teachings are accepted and laws and regulations are enacted to enforce its precepts. This conforms naturally to the conviction which those who rule the destinies of civilized nations entertain regarding the incalculable benefits to be derived from effective compliance with the scientific action of the medical branch whose principal object is to prevent disease. Only in those unfortunate countries whose rulers try to darken the powerful light of Edison's century and who sacrifice all interests to their selfishness and to the convenience of their own friends or parties, hygiene, like many other grand achievements, has no opportunities and almost no attention is paid to it. Taking this into consideration, we naturally come to the conclusion that in the great majority of those backward countries the inhabitants suffer not only from endemic and epidemic

diseases which should not produce so much harm nowadays, but from others which, according to the achievements of modern science, should be stamped out almost completely. This state of affairs is not only harmful to the interests of the country in which so little attention is paid to hygienic precepts, but imperils all the other countries with which it has commercial relations, and which at any moment may receive the contagion. At present, when medical science has progressed so much, and when clinical observation, together with the microscope and chemical analyses, has made so many conquests, carrying light into the darkness, which involved all the avenues which lead to the knowledge of the productive causes of the ailments of mankind, it is necessary that we as apostles of health should help to the utmost of our capability the establishment in our respective countries of a hygienic service which shall correspond to modern requirements. It seems to me that this subject suggests, on our part, a very important duty to our several countries and that we must work diligently until we succeed in bringing our peoples as near as possible to the position occupied by those nations which are the standard bearers of progress, and which, convinced of the importance of hygiene give to it a prominent place in their public administration. Unfortunately, in the great majority of our Spanish-American countries hygiene does not receive the attention it deserves, and we generally have only imperfect hygienic services in charge of incompetent persons, who very often ignore even the most rudimentary principles of the branch to which they are dedicated. If we refer to our seaports we find that, generally speaking, they lack the indispensable sanitary service, endangering not only their local interests, but those of the countries with which they are in contact. The official physicians are badly compensated, and in consequence we rarely have able men in charge of the important positions of health officers. In the great majority of the ports of Spanish-America they do not have quarantine structures properly situated and with the necessary requirements. In one word, we do not have the organization nor the complete hospital conveniences to isolate cases of contagious diseases as they may appear, and besides we are not prepared to properly enforce quarantine among the passengers and vessels which may come from infected ports. To this deficiency in what appertains to prophylactic medicine in our ports are due the extraordinary measures taken by our Governments in cases of probable danger, as, for example, from the importation of Asiatic cholera. In these cases our Governments dictate extreme measures which should not be tolerated nowadays, when the character of contagious diseases, their periods of incubation, and their methods of propagation are known. Last year on account of the menace of cholera in Central America, Colombia, Brazil, and other countries of South America, the ports were entirely closed to all vessels arriving from infected or suspected ports. Now, this measure, it matters not in what light we may consider it, is extremely inhuman, and this consideration is in itself sufficient to admonish us to prepare ourselves so that we may receive those vessels without any danger, attend those who may be unavoidably ill, and do in due form all that may be required for the disinfection of baggage, merchandise, etc. Not only the dictates of humanity, but the commercial interests of our countries, demand the establishment of a good system of quarantine which will interfere as little as possible with traffic, so as to injure our commercial prosperity to the smallest extent. All these considerations have induced me to propose to the high judgment of this distinguished assemblage a project for the establishment of an international system of quarantine and maritime hygiene obligatory upon all the different sections which form the world of Columbus. As this subject would have to be a matter of necessary legislation in our respective countries, I think that we might confine ourselves for the present to discussing its importance, and if my illustrious compeers should be of my opinion a commission might be appointed by the Pan-American Medical Congress to study the matter

properly, and to propose whenever and wherever the congress may designate the best plan to carry out the project. Recapitulating, I would say: I propose the establishment of a system which might be called "the Pan-American system of quarantine and maritime hygiene." The foundation of the whole system should rest on a general code, which should comprise all that is accepted to-day by science in this matter. This code should be adopted by all the nations of the American continent and adjacent islands. Each constituent country should have a national board of health residing in its capital, and also auxiliary boards in other cities, and principally in the seaports, all subordinate to the national board of health. Each national board of health should be the central medical authority for each country, and all the national boards should be under the general direction of a central international board of health, which should be the head of the whole system. The central board should be established in an important city well situated for communication with all the countries which constitute the system. I propose as the desired point for the central board of health the city of Washington, D. C., not only because it is the capital of our eldest and most advanced sister, but on account of its especial position, which best adapts it to serve as a center to the entire system. The details of organization of the several boards, officers, etc., and the by-laws, general and special, it seems to me, should not be entered into here, because they must be taken into consideration by the commission, to whose appointment I referred before. To carry to a happy solution the project which I have the honor to initiate, I believe it would be advisable that, having accepted the idea, the Pan-American Medical Congress should ask the Government of the United States to propose to the governments of the countries which form the continent and adjacent islands to appoint delegates with full powers to discuss and act upon the subject in question at the meeting which should take place as soon as possible in accordance with the resolutions adopted by the Pan-American Medical Congress. Once established, the Pan-American system of uniform quarantine and maritime hygiene might enter into an understanding with the systems prevailing in the Old World, and we might ultimately come to an agreement in the matter that would lead to the adoption of universal quarantine regulations. The importance of the system which I propose can hardly escape the approval of my able fellow-members whose attention I hope to interest. The establishment of a hygienic organization of this class will not only serve to protect the health of our respective countrymen, but it will be of immense service to the commercial transactions which signify so much to the material prosperity of all, but more especially to that of our new countries. Moreover, the strict observance of fixed precepts, scientifically based, obligatory on all our countries, will be of service also to prevent those countries which might be unfortunately visited by an epidemic from communicating it to all the others with which it is connected by travel and transportation. As a matter of course, once the system is well established, all the appointments of medical officers will be properly made by the national boards of health, which will also see to it that all the quarantine requirements shall be such as to give complete satisfaction. A quarantine system well established will make it, if not impossible, at least very improbable for the United States and Europe to send Asiatic cholera to our Spanish-American countries, and at the same time will protect them from receiving yellow fever from us.

I will conclude, hoping that my incoördinate ideas will serve as a starting point to a thorough study of the subject in question, which will have as a happy consequence the establishment of the system which I have had the honor of proposing to your consideration. If we should succeed in carrying it through, I am fully convinced that it would become a great blessing to our countries especially and a benefit to the world at large; and unless such measures be adopted we can never aspire to be looked upon as progressive in medicine or in commerce.

HISTORIQUE DU SIPHON. GAZÉIFICATION PAR L'ACIDE CARBONIQUE LIQUIDE.

Par le Dr. PROSPER DE PIETRA SANTA, de Paris.

I.

Parmi les questions d'actualité les plus étudiées et les mieux élucidées par la Société française d'hygiène, au triple point de vue technique, industriel et sanitaire, je n'hésite pas à placer celle de l'eau de Seltz à Paris. Effectivement, elle a été l'objet: (1) De communications importantes faites en séance par MM. Mondollot, Durand-Fardel, Gantrelet et Peyrand, communications qui ont donné lieu à d'intéressantes discussions. (2) D'analyses chimiques et bactériologiques entreprises dans le laboratoire d'analyses de la Société par MM. Lebaigne, Dupré et en dernier lieu par MM. Ferdinand-Jean et Bruhat. (3) D'expériences et de constatations variées instituées par l'une de vos commissions sous la présidence de M. Fichet, alors que s'est posé le problème de la gazéification possible des eaux par l'acide carbonique liquide. Dans ces diverses circonstances, la Société restait bien dans son programme d'applications pratiques puisqu'il s'agissait d'établir les meilleures conditions de fabrication d'une boisson hygiénique par excellence, et pouvant en outre être fournie aux consommateurs à des prix des plus abordables pour les petites bourses.

D'autres sentiments non moins respectables avaient stimulé le zèle de plusieurs de nos chers collègues, en portant la lumière et la vérité dans une question d'hygiène industrielle intentionnellement obscurcie: d'une part, par la concurrence déloyale des propriétaires de l'eau anglo-allemande d'Apollinaris; de l'autre par les craintes, les appréhensions, voire même les accusations formelles de savants chimistes qui semblent s'être fait une spécialité de la plombophobie.

Si, en ma qualité d'inspecteur des établissements d'eaux minérales du département de la Seine, j'ai dû prendre une part assez active dans cette levée de boucliers contre des procédés peu corrects et inconsidérés, c'est que j'avais à cœur de défendre une corporation honnête, dans laquelle nous comptons plusieurs collègues dévoués. A aucun moment, du reste, je n'ai hésité à me départir des instructions souvent prime-santières de l'administration préfectorale, que je me suis toujours efforcé de représenter dans ses attributs de surveillance, de contrôle et de protection. J'avais devant moi un syndicat des fabricants d'eaux gazeuses, dans lequel figuraient des industriels, les premiers intéressés à l'amélioration et au perfectionnement de leurs produits. En faisant pour ainsi dire cause commune avec eux, j'arrivais au seul but désirable, celui du respect le plus absolu des préceptes de l'hygiène, des exigences légitimes de la santé publique.

Lorsque je suis entré dans l'inspection, en 1874, j'ai trouvé l'industrie des eaux gazeuses en face d'objections, de réserves, d'accusations même, d'une certaine gravité. Au moment de la quitter, en 1893, par suite du rattachement du service au laboratoire municipal d'analyses, je puis affirmer ici hautement, comme je l'ai fait naguère devant l'Académie des sciences, qu'à Paris, à l'heure présente:

L'eau de Seltz, boisson hygiénique de premier ordre, peut être désormais livrée à toutes les classes de la population dans des conditions irréprochables de pureté, d'agrément et de salubrité.

J'ai donc le droit de féliciter la Société française d'hygiène de son intelligente initiative et du succès de cette campagne sanitaire, en remerciant vivement ceux de ses membres qui se sont constitués de zélés collaborateurs.

MM. Marié-Davy, Mondollot, Pellet, Lebaigne, Dupré, Gautrelet, Peyrand, Ferdinand-Jean, Bruhat, Fichet et Cerckel.

II.

Je me propose maintenant d'exposer brièvement, non pas toutes les phases de la question, mais bien les deux principales relatives aux progrès réalisés: (1) Dans la construction du siphon. (2) Dans le mode actuel de gazéification. Pour mettre les uns et les autres en pleine lumière, et dans une pensée d'impartialité, je commencerai par rappeler les opinions soutenues dans des publications récentes par deux membres autorisés à l'Académie de médecine, un chimiste, M. Armand Gautier, et un médecin thérapeute, M. Constantin Paul.

Dans le chapitre, Eaux potables, de l'Encyclopédie d'hygiène et de médecine publique (Dr. J. Rochard, tome II, 3e fasc., p. 404, Paris, 1890), M. A. Gautier s'exprime en ces termes:

Les eaux gazeuses artificielles, dites à tort eaux de Seltz, s'obtiennent en chargeant l'eau potable, enfermée dans des appareils métalliques généralement en cuivre étamé, d'acide carbonique comprimé dans ces récipients sous une pression de 2 à 4 atmosphères.[1] Ces eaux artificielles ont plusieurs inconvénients: Le principal pourrait être évité si les fabricants pouvaient s'astreindre à n'employer que de bonnes eaux potables ou filtrées à travers des vases de porcelaine ou même de grès. Mais il suffit d'examiner ces appareils, dits siphons, après les avoir gardé quelques jours à la cave, pour y constater, le plus souvent, des parcelles ou flocons de matière organique en suspension ou accumulée au fond du récipient. De telles boissons présentent les inconvénients des eaux potables non filtrées, boissons peu agréables qui deviennent dangereuses en temps d'épidémie.[2]

Un second désavantage de ces eaux dites de seltz, c'est qu'elles contiennent souvent, comme je l'ai démontré ailleurs,[3] et comme je m'en suis assuré de nouveau depuis en maintes occasions, du plomb dissous ou en suspension à l'état d'hydrocarbonate.

Ce dangereux métal est emprunté aux appareils métalliques en cuivre étamé souvent à l'étain plombiféré, où l'on a chargé ces eaux d'acide carbonique sous pression, condition qui favorise l'attaque du métal.

Cette dissolution du plomb d'étamage est activée à la fois par les matières organiques de l'eau et par le gaz carbonique dissous. Dans tous les cas, il est nécessaire de se préoccuper du danger que fait courir l'usage de boissons si répandues, car chacun connaît les coliques, les céphalalgies, et les autres désordres nerveux qui sont la conséquence de l'absorption continue de ce métal vénéneux même à faibles doses.[4]

Ces eaux ont enfin un dernier inconvénient. Le gaz carbonique n'y est tenu que mécaniquement en dissolution, contrairement à ce qui a lieu dans les eaux gazeuses naturelles, où ce gaz est pour ainsi dire attiré par les carbonates calcaires, magnésien ou alcalin, qui entrent dans leur composition. Aussi le gaz carbonique fortement comprimé des eaux gazeuses artificielles se dégage-t-il violemment dès qu'il arrive dans l'estomac à une température un peu élevée, et par sa masse et sa tension fatigue ou excite outre mesure cet organe.

Comme on le voit par cette longue citation, l'éminent professeur de chimie de la Faculté de médecine de Paris, n'est pas partisan de l'eau de Seltz, et cependant il renonce cette fois à incriminer la teneur en plomb des armatures, ou têtes de siphon dont l'alliage métallique contenait autrefois une préparation de 20 et 25 pour cent de plomb (le degré de tolérance administrative n'étant que de 10 pour cent), mais qui aujourd'hui ne renferme plus qu'une quantité minime de 4 ou 5

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[1] C est là une lourde erreur, car à cette pression la vidange complète du siphon deviendrait impossible. Dans toutes les fabriques, au moment de l'emplissage le manomètre placé sur le ballon gazéificateur marque 10, 12 et 14 atmosphères.

[2] Actuellement toutes les fabriques de Paris sont abonnées aux eaux de source (Dhuys, Vanne), et pourvues de filtres bien conditionnés (filtres Bourgeoise, filtres Maillé, filtres Pasteur-Chamberland, filtres Maignen, etc.

[3] Le cuivre et le plomb dans l'alimentation et l'industrie. Vol. in 8°, Paris, 1881.

[4] Dans une note insérée aux comptes rendus hebdomadaires de l'Académie des sciences (novembre 1892), de Gautier écrit: "J'ai montré qu'à la dose de 0 gr. 014 de plomb, par jour, pris sous diverses formes, en particulier par les eaux potables, 34 personnes sur 100 seulement ont présenté des phénomènes notoires d'intoxication saturnine. À une dose plus faible, le pour cent tombe nécessairement au-dessous À la dose de 0 gr. 0005 à 0.0002, par jour, il semble n'y avoir plus d'intoxication possible.

pour cent de plomb. D'une manière générale, on peut dire que les grands fabricants d'appareils (Mondollot, Guéret, Durafort, etc.) ne livrent plus aux fabricants d'eaux gazeuses que des siphons en étain pur et régule avec absence totale de plomb.

Quant à M. Constantin Paul, dans un volume, Les eaux de table, publié ces jours derniers en collaboration de M. le Dr. Rodet de Vittel, il ne semble pas connaître l'outillage et le fonctionnement de l'usine.

Après avoir rappelé les expériences faites à Munich par M. le Dr. Leone dans le laboratoire de M. Pettenkoffer, il ajoute:

Cela prouve que l'acide carbonique est un mauvais milieu de culture, et qu'il n'y aurait pas d'inconvénient de boire de l'eau de Seltz si elle ne contenait pas trop souvent un poison qui tue bien plus sûrement que des centaines de mille de bactéries, je veux parler de d'hydrocarbonate de plomb qui s'y trouve dissous, ou en suspension, ainsi que l'a montré A. Gauthier.

Ce plomb provient de l'étamage des têtes de siphon [*sic*][1] et est dissous avec d'autant plus d'énergie, que l'eau contient des matériaux organiques, et que l'acide carbonique y est dissous sous pression.

Ces eaux ont encore un inconvénient, c'est que l'acide carbonique s'y trouve en dissolution mécaniquement et sous une forte pression : aussi lorsqu'il arrive dans l'estomac s'y dégage-t-il violemment en distendant l'organe ce qui le fatigue et l'excite inutilement.

En outre, l'eau de seltz artificielle étant généralement fabriquée avec le bicarbonate de chaux et l'acide sulfurique contient souvent une certaine proportion de ce dernier entraînée mécaniquement dans le dégagement gazeux plus ou moins tumultueux de la réaction.[2]

Cette proportion atteint rarement 500 milligrammes par litre : généralement elle est inférieure à 250 milligrammes. La présence de cet acide n'en est pas moins fâcheuse, car elle peut amener des troubles gastriques chez des sujets délicats.

Voilà donc bien établi le bilan des accusations portées contre les eaux de Seltz par deux savants académiciens qui les ont formulées dans le silence de leur cabinet de travail, sans même s'être donné la peine de visiter une fabrique actuelle d'eaux gazeuses, à l'effet de controler les faits nouveaux qui réduisent à néant de vieilles assertions passées pour ainsi dire à l'état de légende.

III.

Sans m'attarder à des démonstrations inopportunes pour ceux qui aiment à conserver leur antipathie pour les eaux minérales artificielles, et toute leur sympathie pour les propriétaires des eaux minérales naturelles, j'entre au cœur même du sujet en exposant le bilan des progrès obtenus.

Ces progrès comprennent : d'une part la construction de siphons perfectionnés, faisant disparaître d'une manière absolue la cause pathogène, le plomb ; de l'autre, la gazéification des eaux de Seltz par l'acide carbonique liquide, chimiquement pur, qui a pour effet immédiat de rendre le liquide antiseptique, antiparasitaïde, et d'annihiler l'action des matières premières suspectes (bicarbonates de commerce, blancs de Meudon, acides muriatique ou sulfurique).

L'historique du siphon pendant cette deuxième moitié du siècle montre une série successive d'améliorations et de perfectionnements. A l'origine de la fabrication des eaux de seltz, on se servait de bouteilles en verre, plus ou moins résistantes, mais sujettes à ruptures et à explosions.

En 1837 l'invention du siphon par Savaresse a doté l'industrie d'un récipient aussi pratique que commode.

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[1] C'est assurément de l'alliage métallique de la tête de siphon, et plus specialement du bec en métal où se fait la vidange qu'à voulu parler l'auteur. C'est en somme l'une des anciennes objections de M. Gautier à laquelle il a dû renoncer par suites d'analyses chimiques des plus précises entreprises par ses contradicteurs.

[2] L'appareil imaginé depuis plusieurs années par Mondollot, dit distributeur automatique de l'acide sulfurique, assure tout à la fois le mélange complet de l'acide et du carbonate terreux et une production régulière d'acide carbonique.

Le siphon se compose, comme chacun sait, de trois parties essentielles: (1) La carafe, jadis de forme ovoïde, maintenant cylindrique, en verre blanc ou colorié, portant gravés sur ses parois le nom et l'adresse du fabricant. (2) La tige, ou tube central, qui traverse la carafe de haut en bas, et par où s'effectue la vidange du liquide carboniqué. Cette tige était à l'origine tout en métal (alliage de plomb et d'étain). Plus tard, au grand profit de l'hygiène, elle a été remplacée par un tube en cristal, portant à sa partie supérieure un petit support métallique, espèce de bague ou d'anneau. Il y a deux ou trois ans, M. Durafort a remplacé avantageusement la tige centrale par une tige en cristal évasée à sa partie supérieure en forme de petit entonnoir, le tout recouvert d'une rondelle en caoutchouc, ce qui permet la suppression de la bague ou anneau métallique. (3) La tête de siphon, ou armature, toute en métal, autrefois formée par un alliage d'étain et de plomb (ce dernier dans les proportions de 15.25 pour cent) actuellement en étain pur et régulé (sulfure d'antimoine).

La partie supérieure de la tête de siphon contient un ressort à boudin, en cuivre rouge, qui facilite le jeu du levier. Le levier est dit petit levier, ou grand levier, selon que le bouchage intérieur de la carafe se fait en dessus ou en dessous du point où l'eau gazeuse sort du siphon, pour s'engager dans le petit bec métallique de petit diamètre placé sur le côté du récipient et par lequel s'opère la vidange.

Malgré ses petites dimensions, cette partie de la tête du siphon a été longtemps incriminée comme pouvant donner lieu à la production, sur place, d'un oxyde ou d'un sous carbonate de plomb, formé au fur et à mesure du passage de l'eau gazéifiée sur les parois métalliques du dit bec.

Si, théoriquement, le fait est possible, l'observation et l'expérience démontrent que la rapidité même du passage de l'eau gazéifiée à 10, 12 et 14 atmosphères de l'intérieur du siphon dans le verre du consommateur, contrarie ou empêche même la production d'un sel plombique sur cette minime surface de contact.

L'analyse chimique vient, à son tour, mettre à néant ces appréhensions de la plombophomanie.

Dans le laboratoire d'analyses de la société, M. Lebaigue a pris de l'eau de seltz contenue dans deux siphons à armatures métalliques, contenant dans l'alliage: la première un alliage de 30 pour cent de plomb, et la seconde une fraction d'unité 0.37 de plomb.

En analysant les deux produits, après vidange complète mais modérée et interrompue, M. Lebaigue a trouvé à la 4e décimale une très-minime différence, à savoir: 0.0007 pour le siphon contenant 30 pour cent de plomb, et 0.0007 pour celui qui en contenait moins de 1 pour cent. Il ne faut pas perdre de vue que ces deux proportions de plomb pouvaient provenir de la canalisation en plomb amenant dans le laboratoire les eaux de la ville. Du reste, sur ce point spécial, M. Durafort a réalisé un perfectionnement important en recouvrant d'une mince couche de porcelaine fine de Limoges les parois intérieures du bec du siphon. Cette couche de porcelaine se continue à l'intérieur et remplit toutes les parties vides autour de la tige centrale, et autour du piston en ébonite qui, actionné par le levier, assure le jeu du siphon.

Comme on le voit par la figure ci-jointe du premier coup d'œil, et d'une manière plus claire que par une description, avec ces ingénieuses dispositions, l'eau carbonique passe du siphon dans le verre du consommateur, sans que sur aucun point du trajet on ait à constater de contact avec l'alliage métallique de la tête de siphon. (Fig. I.)

Pour compléter cet historique, et sans me préoccuper des questions des brevets d'inventions qui sont la légitime propriété des inventeurs, et qu'ils défendront par tous les moyens de droit, je signalerai deux perfectionnements récents: l'un d'eux nous arrive d'Angleterre, l'autre est d'origine française.

Dans le new patent : Glass-lined throughout siphon head, la couche de porcelaine du siphon Durafort est remplacé par une tige en cristal d'une seule pièce dont l'ouverture intérieure se trouve à la hauteur du disque piston en ébonite qui en s'abaissant assure le jeu du siphon. (Fig. II.)

Le résultat final est le même ; couche de porcelaine, ou tube de cristal, c'est en somme le passage de l'eau gazeuse sans contact possible avec le métal.

Dans le siphon de Bordeaux l'armature métallique, ou tête de siphon, est remplacée par une tête en verre, tout en cristal et d'une seule pièce. Les seules parties métalliques (en étain pur) sont des larges bagues à l'extérieur, indispensables pour fixer la tête du siphon sur le récipient en cristal. (Fig. III.)

Le jeu du siphon se fait dans ce système par un levier agissant de haut en bas, et actionnant le disque piston qui par son abaissement favorise le passage de l'eau de Seltz sans le bec de vidanges tout en cristal.

IV.

MODES DE PRODUCTION DU GAZ ACIDE CARBONIQUE.

J'arrive à cette question spéciale : d'une manière générale, le gaz acide carbonique CO^2 pour la gazéification de l'eau de Seltz s'obtient, soit par la réaction d'un acide sulfurique ou hydro-chlorique sur des carbonates alcalins ou terreux (craie, blanc de Meudon, marbre, carbonates de soude, de chaux), soit par la désagrégation des carbonates et bicarbonates de soude au moyen de la chaleur (haute température). Les grandes fabriques utilisent le blanc de Meudon : celles qui sont outillées avec les appareils à production demi-continue ou continue de MM. Mondollot, Herman-Lachapelle, Guéret, Durafort, etc., utilisent le carbonate de soude du commerce traité par l'acide sulfurique ou muriatique.

En 1868, Ozouf trouvait dans la combustion du coke une source plus directe de CO^2. Le gaz produit était engagé dans une combinaison alcaline laquelle décomposée à son tour par une température élevée, lassait dégager le gaz CO^2. Dans le système hollandais Bens, le CO^2 est tiré du bicarbonate de soude au moyen de la chaleur élevée d'un fort bec de Bunsen.

Le gaz produit passe à travers un réfrigérant Liebig pour se rendre dans des condensateurs en fer garnis de charbon. L'embouteillage se fait dans de petites bouteilles à billes du système Codd.

Dans les appareils domestiques dits gazogènes Briett-Mondollot, le CO^2 est demandé à l'action de l'eau sur l'acide tartrique et le bicarbonate de soude.

Dans ces derniers temps, M. Taquet a cherché à utiliser l'acide carbonique recueilli dans la fabrication des vins de raisin sec. Le gaz arrive dans des chambres ad hoc, où il vient saturer des carbonates du commerce.

Les bicarbonates qui résultent de cette saturation sont alors traités dans l'usine par la chaleur et fournissent un gaz très-pur.

Quelque soit le mode de production du CO^2, le gaz une fois produit et convenablement épuré est refoulé à l'aide de pompes en même temps que l'eau (préalablement filtrée) dans de récipients en cuivre, étamés à l'étain fin, où s'opère la saturation de l'eau par l'acide carbonique.

Le degré de compression est indiqué par le manomètre extérieur qui surmonte le saturateur et porté à 10, 12 et même 14 atmosphères selon le degré de la température ambiante.

V.

Les spécimens d'appareils pour fabrication des eaux gazeuses exposés dans la grande galerie des machines (du champ de Mars) pendant l'Exposition Universelle de 1889, ne laissent plus aucun doute sur la possibilité, et l'opportunité, d'utiliser pour la fabrication des eaux de Seltz et des limonades gazeuses, l'acide carbonique liquide.

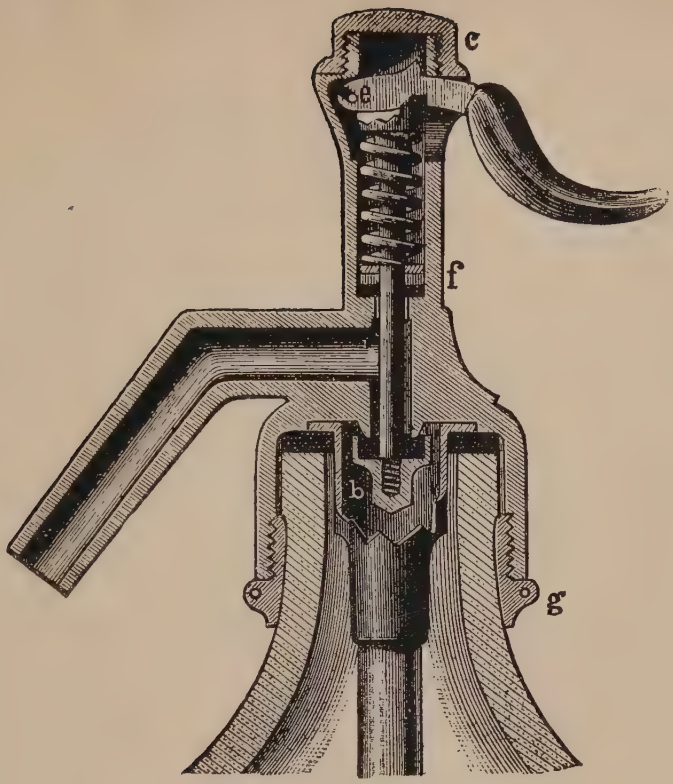

Fig. I.—Système Duraford.

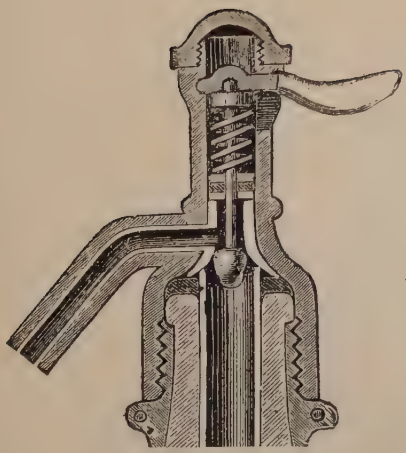

Fig. II.—Système-lined glass.

Fig. III.—Système Delorme.

Depuis les travaux et expériences de Faraday, de Pouillet et surtout de Thilorier, sur la liquéfaction des gaz, l'acide carbonique liquide dont la préparation était restée longtemps dans le domaine de la science et s'exécutait seulement, et non sans dangers, dans les laboratoires, est devenu un produit industriel à applications aussi nombreuses que variées.

L'outillage de l'usine est considérablement réduit, et la fabrication plus prompte des produits exige moins de main d'œuvre. Ceux-ci sont du reste plus agréables et plus sains puisqu'on se débarrasse, du même coup, du blanc de Meudon qui avec ses incrustations de micro-organismes donne parfois à l'eau de Seltz un goût désagréable ou nauséeux, et de l'acide sulfurique, qui malgré ses lavages répétés peut laisser à l'arrière gorge une sensation d'acreté.

L'acide carbonique liquide est incolore, mobile et remarquable par sa grande dilatabilité; son coëfficient de dilatation est plus grand que celui des gaz, ce qui lui donne une force considérable, bien supérieure à celle de la vapeur d'eau.

Le litre d'acide carbonique gazeux pèse 1 gr. 529, et le litre d'acide carbonique liquide pèse 0 kil. 838. Par conséquent un litre d'acide carbonique liquide pèse autant que 548 litres 75 d'acide carbonique gazeux.

D'après ces chiffres, on voit qu'il y a grand avantage, dans la fabrication des aux gazeuses à employer sous un petit volume une quantité d'acide carbonique répondant à un volume 548 fois plus grand que celui qu'on emploie actuellement. (Dupré.)

L'acide carbonique liquide peut devenir solide lorsqu'il est projeté sur une boite métallique à parois minces, une grande partie se volatilise en enlevant la chaleur nécessaire à son changement d'état aux parois du vase et à la portion de l'acide restée liquide. La température s'abaisse peu à peu. Quand elle est descendue à 70° au dessous de zéro, l'acide carbonique restant se solidifie et prend l'aspect d'une neige blanche floconneuse qui a 80° au dessous de zéro.

C'est par le fait de cette propriété de l'acide carbonique liquide de se solidifier par l'action même du calorique emprunté à la partie restante par la partie qui se solidifie, que pendant le fonctionnement des bouteilles ou canons, on constate la formation de petits glaçons qui viennent obstruer l'ouverture du dégagement du gaz, surtout si l'on ne prend pas la précaution d'ouvrir petit à petit le robinet à frein qui la termine.

Ce refroidissement, au fur et à mesure que la bouteille d'acide carbonique liquide se vide, se manifeste sur les parois de la bouteille elle même par une épaisse couche de neige.

La première application de l'acide carbonique liquide à la fabrication des eaux gazeuses a été faite à Hanôvre en 1870. Petit à petit ce système s'est généralisé en Allemagne, en Autriche et en Russie.

En France, c'est seulement vers 1884 que l'acide carbonique liquide a été utilisé, en lieu et place de l'air comprimé, pour le fonctionnement des pompes à bière. Le procédé est des plus ingénieux: on commence par dégager l'acide carbonique liquide dans un tambour jusqu'à ce qu'il y ait atteint une pression de 2 atmosphères, et c'est ce tambour ainsi chargé et mis, au moyen d'un tuyau, en communication avec le tonneau à bière qui donne la pression.

Il en résulte que, durant toute la vidange, la bière est soustraite au contact de l'air extérieur; de plus, tandis qu'avec les pompes, l'acide carbonique contenu dans la bière se diffuse dans l'air comprimé contenu dans le tonneau, avec le nouveau système l'acide carbonique, que fait la pression, se dissout dans la bière, et lui donne un goût piquant en la rendant plus agréable.

Pendant les premiers temps ce produit (acide carbonique liquide) était fourni par l'usine Krupp à Essen. Il arrivait à Paris dans de forts cylindres en fer forgé dits bouteilles ou *canons*, de la contenance de 8 kilogrammes d'acide carbonique liquide comprimé à 70 et 80 atmosphères.

C'est à la séance de la Société française d'hygiène du 6 avril 1886, et à propos d'une intéressante communication de M. Mondollot sur *l'Industrie des eaux de Seltz* que M. Fichet l'un de ces vice-présidents, posa, le premier, ce point d'interrogation : Est-il possible d'utiliser l'acide carbonique liquide pour la fabrication des eaux gazeuses?

Cette fabrication était possible, puisqu'elle se faisait depuis plusieurs années en Allemagne. Toutefois, M. Mondollot formulait, séance tenante, trois objections sérieuses : (1) "Il n'est pas logique, d'employer une force pour condenser un gaz que l'on est obligée de détendre ensuite. (2) Il est dangereux, de manier des appareils remplis à la pression de 70 à 80 atmosphères, pression indispensable pour liquéfier le gaz acide carbonique. (3) La cherté du produit le rend inabordable aux fabriques parisiennes, puisque le prix de revient d'un siphon d'eau de Seltz obtenu par l'acide carbonique liquide serait 7 à 8 fois plus élevé que le prix de revient des matières premières d'usage courant."

Malgré le bien fondé de ces objections, M. le Secrétaire Général proposa de nommer une commission chargée d'étudier la question au double point de vue théorique et pratique.

Cette étude, ajoutait-il, formerait d'ailleurs le complément logique de la question relative aux propriétés antiseptiques du gaz acide carbonique.

La commission composée de MM. Brillié, Dupré, Fichet, Moreau de Tours et de Pietra Santa se mit immédiatement à l'œuvre, et quelques jours après elle assistait à des premiers essais dans l'une des grandes fabriques de la capitale.

Ces essais furent des plus satisfaisants. Le canon de 8 kilogrammes d'acide carbonique liquide fourni par la maison Krupp fut mis en communication avec le gazomètre de l'usine ; le tirage des siphons s'effectua comme à l'ordinaire et le chiffre des siphons s'éleva à 800.

De l'avis unanime des membres de la commission, l'eau de Seltz était plus agréable au goût que celle obtenue par le blanc de Meudon et l'acide sulfurique.

Le second essai dans une fabrique moins importante porta plus spécialement sur les limonades gazeuses. Cette fois la gazéification s'effectua directement du canon d'acide carbonique liquide (surmonté d'un manomètre et muni de robinets spéciaux par l'ouverture et la fermeture. La fabrication fut très-prompte, et les diverses boissons gazeuses furent jugées de beaucoup supérieures aux produits similaires de l'usine.

Toutefois, cette double expérience, ne résolvait pas les objections de la cherté du produit, et du tribut à payer à l'industrie allemande.

Pendant que la commission se demandait, s'il n'y aurait pas moyen de recueillir le gaz acide carbonique naturel aux sources thermales de Vichy, ou de Royat, en l'emmenant, sur place et par un outillage spécial, à l'état liquide, MM. Cerckel et Fichet (de la Société des produits antiseptiques) nous annoncèrent qu'ils étaient en mesure, dans leur usine de Villers, de fournir un gaz acide carbonique liquide, chimiquement pur, produit par la combustion du coke, et vendu aux fabriques d'eau de Seltz au prix de 10 francs le canon.

Je ne saurais dissimuler la satisfaction que nous avons tous éprouvée à ce moment. En possession d'un produit avec marque de fabrique française et livré à un prix très-abordable, nous avons poursuivi avec persévérance notre propagande, toute de persuasion, en faveur de la réforme industrielle, qui représentait à nos yeux un progrès hygiénique très-notable.

VI.

Il ne me paraît pas superflu de passer en revue les divers modes de production de l'acide carbonique liquide employés à l'étranger[1] et en France[2].

A Berlin, la maison Kunheim a construit un établissement du même genre dont la vente journalière pour l'Allemagne seulement est de 200 bouteilles ou canons de 8 kilogrammes chaque.

A Vienne, cette nouvelle fabrication des eaux gazeuses par l'acide carbonique liquide y a été introduite par l'ingénieur Haseword. Son procédé consiste à faire réagir l'acide sulfurique étendu d'eau et débarrassé de toutes traces d'arsenic sur le carbonate de magnésie pur. Il permet d'obtenir 450 kilogrammes de liquide par journée de 12 heures.

On applique également à Vienne le principe des compressions successives, de manière à obtenir une pression de 50 à 60 atmosphères.

L'acide carbonique liquide est alors emmagasiné dans des réservoirs en tôle dont les fonds sont soudés à leur partie cylindrique. Ces réservoirs préalablement éprouvés à 250 atmosphères contiennent chacun 20 kilogrammes du produit.

En Belgique, la Société La Carbonique de Louvain prépare en grand l'acide carbonique liquide en refoulant l'acide carbonique gazeux dans des bouteilles en fonte où il se liquéfie sous sa propre pression. Chaque bouteille renferme environ 10 litres d'acide carbonique liquide qui à la pression ordinaire fournissent 4,500 litres d'acide carbonique gazeux.

La préparation en grand de l'acide carbonique liquide permet de le produire chimiquement pur.

Les gaz provenant de la combustion de l'oxide de carbone d'un gazogène Lencauchez au coke sont lavés soigneusement pour en éliminer l'acide sulfureux et refoulés dans des appareils pourvus d'agitateurs convenables, et renfermant des solutions de carbonate de soude ou de potasse.

L'acide carbonique est absorbé, tandis que l'azote et l'oxygène en léger excès s'échappent dans l'atmosphère. La solution de bicarbonate alcalin est introduite dans une chaudière et soumise à l'ébullition par la chaleur résultant de la combustion des gaz du gazogène qui servent à la production de l'acide carbonique dilué. L'acide carbonique se dégage à l'état de grande pureté, tandis que le monocarbonate sert à une nouvelle absorption.

Le gaz carbonique est recueilli dans un gazomètre, d'où il est aspiré pour être comprimé dans un appareil à plusieurs cylindres, et amené ainsi successivement à 25 et 60 atmosphères. Il est refroidi soigneusement au sortir de chaque cylindre.

Ainsi produit, l'acide carbonique liquide est emmagasiné dans des cylindres en fer forgé (bouteilles ou canons) timbrés par une pression de 250 atmosphères, de la capacité de 12 litres environ et de la contenance de 10 kilogrammes.

Un appareil détendeur inventé par M. Froideral, ingénieur à St.-Quentin, permet de laisser échapper le gaz des bouteilles, sous une pression réduite et facile à règler. (Bulletin de la Société d'encouragement pour l'industrie nationale, séance du 22 février 1889.)

Le contenu de ces bouteilles d'acide carbonique liquide est livré aux fabricants d'eaux gazeuses à un prix qui est descendu successivement de 30 francs à 10 et même à 8 francs. Dix kilogrammes du produit suffisent à la préparation de 1,200 siphons d'eau de Seltz. Le jour où les dits fabricants auront un matériel de bouteilles, à eux appartenant, l'acide carbonique liquide pourra leur être livré à un prix beaucoup moindre.

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[1] Le procédé employé à Hanôvre consiste à pomper le gaz CO^2 lavé et desséché dans une série de récipients de pluf en plus petits jusqu'au moment où l'on obtient la liquéfaction à 0° et sous une pression de 36 atmosphères.

[2] Pour les usines françaises j'indiquerai seulement ici celui qui s'est le plus vite généralisé en raison même de sa supériorité. Dans l'usine de Villers, près Hernies (Oise), (Société des produits antiseptiques), l'acide carbonique liquide est préparé par la compression directe du gaz carbonique très pur obtenu d'une façon toute originale à l'aide d'un appareil basé sur les indications de MM. Orouf et Moisson et perfectionné par M. Gall.

CONCLUSIONS.

En résumé, voici mises en parallèle pour la fabrication à Paris des eaux gazeuses (eau de seltz, limonades gazeuses, soda-water, etc.), la situation d'autrefois et la situation d'aujourd'hui.

Dans le passé: (1) Eaux de fabrication suspectes, imparfaitement filtrées ou plus ou moins contaminées. (2) Présence du plomb sans les armatures ou têtes de siphons; et étamage défectueux des grands appareils en cuivre de l'usine. (3) Matières premières de la fabrication plus ou moins sujettes à caution au point de vue sanitaire.

Dans le présent: (1) Eaux de source ayant séjourné préalablement dans des filtres perfectionnés. (1) Alliage métallique des têtes de siphon, exempt de toutes traces de plomb. (3) Récipients ou carafes dans lesquels, par d'ingénieuses dispositions, il n'existe plus aucun contact métallique entre le contenu (eau chargée d'acide carbonique), et le contenant (siphon en cristal). (4) Gazéification par l'acide carbonique liquide, gaz chimiquement pur, et offrant par cela même toutes les garanties désirables pour l'hygiène privée et pour la santé publique.

EL BOCIO (GOÎTRE) EN LA AMÉRICA DEL SUD.

Por el Dr. SAMUEL GACHE.

Medalla de oro en el Concurso Sud-Americano de Medicina celebrado por el Círculo Médico Argentino en 1893; Miembro de la Société Française d'Hygiène de Paris; Oficial de Academia; Delegado del Gobierno Argentino en el Congreso Internacional de Higiene y Demografía, de Paris, en 1889; Médico del Hospital Ravoson, de Buenos Aires, etc.

Entre las endemias de la América del Sud, el bocio es una de las más extendidas.

Se ha incriminado á la naturaleza geológica de los terrenos la causa de esta deformidad, pero se ha desistido de tal inculpación en vista de los resultados negativos que muestran á aquella desarrollándose en suelos de distinto origen, y se ha buscado con más sério fundamento en la composición de las aguas, la etiología de mal tan generalizado, y así mismo su estudio en tal sentido no ha satisfecho á todos. Se ha atribuido á la falta de oxígeno, iodo y bromo en el agua: se ha pensado en las aguas en las cuales la magnesia forma el 25 por ciento del total de las sales; se ha achacado al fluoruro de calcio, etc., pero no es posible considerar estas opiniones sino como apreciaciones particulares de hechos aislados y que ponen de manifiesto resultados contradictorios, puesto que el mismo fenómeno—el bócio—se observa en condiciones esencialmente distintas.

Las aguas de nieve derretidas, dice Boussingault, se consideran por algunos como causas de coto en los que tienen que hacer uso de ellas; y efectivamente, en la Nueva Granada se observa esta enfermedad en los lugares cuyos habitantes beben de ordinario estas aguas, como sucede con los habitantes de la ciudad de Mariquita, situada en las orillas del Guali, que sale del nevado de Ruiz, con los de Ybaque que viven en las márgenes del Combeina que desciende del Toluna; pero la mayor parte de los pueblos en donde el coto es endémico estan sin embargo muy distante de los nevados, y las aguas que en ellos se beben no provienen de la nieve derretida. El autor ántes citado, refiriéndose á sus observaciones verificadas en aquel país, dice que no conoce bien allí sino dos lugares donde los habitantes beben exclusivamente agua de manantial, y son Nemocón en la provincia de Bogotá, que posee un abundante manantial que brota de la piedra arenisca, y la ciudad del Socorro, cuyos habitantes beben aguas de manantiales que salen de la roca caliza. En esta última los cotos son muy comunes y voluminosos, y en Nemocón no observó uno solo.

Tenemos pues dos hechos: las aguas que corren por rocas de cuarzo insolubles no ejercen acción ninguna sobre la glándula tiroides, y los individuos que beben el agua que sale de una roca caliza, soluble en parte por el ácido carbónico que contiene, ven esta glándula hipertrofiarse y llegar á un desarrollo enorme. Y de aquí nace el problema de si la naturaleza de los terrenos que las aguas cruzan tiene ó no, influencia en el aumento de la tiroides: problema que muchos autores han resuelto, estableciendo después de sérios estudios que, con escepción de las rocas calizas, la naturaleza del suelo no parece ejercer influencia alguna sobre la frecuencia de los cotos, y que esta influencia, si efectivamente la hay, no se estendería sinó á los lugares en donde existen las rocas calizas secundarias, siendo así que en la mayor parte de los lugares en donde el coto es endémico no hay rocas calizas.

La suposición de que el agua al salir de los nevados ó de las altas montañas produce cotos en los que las injieren, y que esta propiedad la pierde cuando se aleja de las fuentes y gana el aire que necesita, se rebate con el hecho de que en lugares bajos y en donde no se emplean las aguas procedentes de las montañas, el coto es, sin embargo, constante, y hasta muy común: pudiendo mencionarse poblaciones importantes en las que se beben aguas que por su orígen contienen poco aire, y en las que solo por excepción se encuentra el bócio. Boussingault refiere que estos últimos hechos han sido comprobados en lugares poblados por Indios, raza que parece exenta de cotos en donde quiera en América; por lo menos, dice, yo nunca he visto indio de raza pura con coto.

En Coloya, en Piedras y en las orillas del Combeyma, abundan los cotos entre los negros, mulatos y mestizos, y los Indios están exentos aunque usan de las mismas aguas. Antes que yo, un célebre viajero había hecho la misma observación. Los indígenas de tez bronceada gozan (dice M. Humboldt) de una ventaja física que depende sin duda de la sencillez del género de vida de sus antepasados por millares de años. Jamás he visto Indios corcobados, y raramente se ven Indios bizcos, cojos ó mancos. En los lugares en donde los habitantes están sujetos á cotos, los Indios carecen absolutamente de esta enfermedad, que se vé pocas veces aún en los mestizos.[1]

En concepto de Bordier, los Indios están en los Andes sujetos al bocio; los mestizos lo son menos; vienen en seguida los blancos, en fin los negros; y como, se vé, estos datos difieren de los anteriores. La observación local nos demuestra lo mismo que ya Boussingault habia notado. Los Indios Quíchuas de Iujuy permanecen inmunes; y esto está en oposición con lo aseverado por Bordier. Los estudios de Grange ilustraron en su época este punto oscuro de la etiología de la endemia de que hablamos, y llamaron la atención sobre la circunstancia de que en todos los valles en donde ella reina, las aguas potables, sea cual fuere el terreno por donde corren, contienen una fuerte cantidad de cloruro, sulfato, y carbonato de magnesia. A su modo de ver, es la falta de cal en las aguas abundantes de magnesia lo que causa el coto y propone hacer pasar las aguas nocivas por filtros ó depósitos llenos de cal carbonatada ó de una capa delgada de cal. El estudio químico de las tierras de las regiones bociógenas, parece igualmente, según autores varios, no dar mucho fundamento á una teoría para encontrar en sus componentes el origen de la enfermedad en cuestión, pero, á nuestro modo de ver, este estudio merece recomenzar, y tal vez algun día se le llegue á asignar mayor influencia de la que hasta hoy se le da. En la acción de algun elemento especial de estas tierras sobre las aguas que las cruzan, ¿no podría fundarse una sospecha que contribuyera á explicar la génesis de los trastornos que nos ocupan? El exámen bacteriológico de dichas tierras prodría iluminar el punto, determinando la clase de germen que obra en estas condiciones.

Rechazadas las teorías qua se han dado para fundar más ó menos científicamente la etiologia que buscamos, y reconocido con Baillarger que existe un agente tóxico, especial, único, siempre el mismo, que afecta los organismos vivos y les imprime

[1] Boussingault, Viajes, etc.

un sello de degeneración siempre idéntico, cuyo primer grado es el bócio y el último el cretinismo, debía irse á la investigación de este agente para comprobar la manera de pensar de Arnould sobre si su causa reside en algunos de los elementos conocidos del agua ó en algún otro desconocido aún. Podrá tal vez, según este autor, referirse al parasitismo, y entonces se reconocerá en aquella la bacteria bociosa. Y así ha sucedido, en efecto. Poco tiempo después de las previsiones del sabio francés, los Dres. Lustig y Carle publicaban los resultados de sus estudios hechos con aguas del Valle de Aosta, donde el bócio es endémico y establecían las siguientes conclusiones: (1) Todas las aguas examinadas que sirven para beber y para los empleos domésticos á los habitantes afectados de bócio endémico, son muy ricas en bacterios. (2) Presencia constante en cantidad variable de un bacilo que licua la gelatina con caracteres morfológicos y biológicos especiales. (3) Los experimentos de hacer beber esta agua, en un territorio exento de bócio, á los caballos y á los perros sanos han demostrado que el agua tiene el poder incontestable de producir un aumento del cuerpo tiroides. (4) No está aún probado que la eliminación de los microbios quite la propiedad bociógena.

La etiología del bócio viene así á quedar bien establecida y confirmada la previsión de Arnould, por la aplicación de la teoría microbiana. La bacteria se encuentra ciertamente en el agua, pero hay que averiguar si esta agua se limita simplemente al rol de vehículo, arrastrando al gérmen que toma del suelo, ó si la bacteria reconoce otra procedencia. Muy posible es que la verdad se encuentra en la primera de estas suposiciones. ¿No es en el suelo donde germina el bacilus malariæ? ¿Porqué no podría también originarse en él el microbio del bócio? Y decimos que probablemente la bacteria se origina en el suelo, fundados en este hecho: las aguas bociógenas no lo son en toda la extensión de su curso; y puede establecerse el principio y el fin de su acción. En otro tiempo se atribuía gran valor etiológico á la herencia en primer lugar, la genitalidad, la altitud, etc. Muy posible es que todas estas circunstancias coadyuven á despertar la enfermedad, preparando el terreno que la bacteria más tarde ha de fecundar; pero ante todo hay que reconocer la acción directa de esta última, cualquiera que sea su punto de origen. Bordier que ha estudiado especialmente estas cuestiones de geografía médica, dice que el bócio se encuentra sobretodo en las montañas y en los países fríos como en los países cálidos, siendo la condición dominante, la permanencia en las montañas. Tal proposición no es del todo exacta por lo que se refiere á la República Argentina, pues vemos el bócio desarrollarse tan pronto en comarcas montañosas como las Provincias de Cuyo y las de Tucumán, Salta y Jujuy, como en la de Corrientes, imponente por su llanura, cubierta de vegetación. Si él reina en las primeras á título de ser en ellas montañoso el terreno, ¿cual razón se invocaría para justificar su presencia en la otra, situada lejos, muy lejos de las montañas?

No puede argumentarse que la menor frecuencia de su invasión en Corrientes probaría la influencia de la altitud, porque si bien hoy allí ataca un número relativamente reducido, en cambio antes de ahora ha hecho muchas víctimas. En ciertos pequeños pueblos de Corrientes, sobre el río Uruguay, se han encontrado en otro tiempo muchos bociosos que parece habían contraído su afección á causa de beber agua del pozo, en lugar de usar de aquel río, infinitamente superior. Es evidente su disminución en esta provincia, y no es posible atribuirla á modificaciones operadas en las condiciones generales del terreno, ni en la vegetación, ni en las aguas. ¿Es que algun foco ignorado se habrá destruido? Más aceptable nos parece la acción del intercambio de las razas que sufren nuestros pueblos del litoral, á los que el estranjero acude con preferencia llevando con su sangre nuevas fuerzas, mayores aptitudes para la lucha y hasta más vigor para resistir al ultraje del clima y á las vicisitudes propias de cada país. ¿Y por qué San Juan, rodeado como Mendoza por los Andes, ha desterrado el bócio? Y San Luis, en las mismas

condiciones, ¿por que tampoco lo tiene, mientras que aquella le paga tributo abundante? Es que hay algo más que la influencia de la altitud en la producción de estos hechos. Y ni siquiera puede invocarse aquí la falta de aereación del agua por que cuando llega á ingerirse ha recorrido trayectos de muchas decenas de leguas.

Su condición más favorable es sin duda alguna la permanencia en país de montaña, siendo elementos que entran en esta condición las distintas circunstancias y agentes climatéricos, debiendo recordarse la influencia de la vegetación, la del suelo considerado en sus componentes especiales, y muy principalmente la de las aguas que cruzan terrenos de diversa constitución, que tienen en disolución ó en suspensión principios minerales tomados de ellos y que conviene estudiar en cada punto. En nuestro país no se origina únicamente en las provincias cuyo territorio está cruzado por montañas, y así es que se presenta en poblaciones muy distintas de ellas y en las que no hay que tomar en cuenta la altitud, que es insignificante y sin valor alguno. Esta condición no es primordial pues en la producción del bocio, si bien ella actúa y se le reconoce en los parajes donde la endemia ataca. Veamos entre tanto cual es su frecuencia en nuestro país. En Mendoza abunda el bocio; y su mayor número se encuentra en las mujeres. En 1879 había en la ciudad 245 de estas con bocio y 65 hombres. Existe en esta provincia, á corta distancia de su capital, un paraje denominado San Vicente, donde esta enfermedad es tan común que entre los habitantes del resto de la misma ha llegado á ser proverbial la calidad de Vicentino ó cotudo, sinónimos para muchos. Cualquiera que haya pasado por dicho punto ha podido cerciorarse de la enorme cantidad de estos infelices. En todas las secciones de su territorio se encuentran de ellos, y su relación oscila, según el Dr. A. Lemos, entre 8 por cada 100 habitantes como en San Vicente, y 1 por cada 100 como en Luján, correspondiendo como término medio á San Martín y la ciudad, 3 por 100. Talvez sea exagerada dicha proporción por lo que respecta á esta ultima; pero no lo es seguramente para los departamentos nombrados. Así pues, Mendoza vendría á estar en igualdad de condiciones que muchos departamentos de Francia, donde la proporción de bociosos es de 7.3 por 100 habitantes, y en otros es de 3 por 1. En todo este país (Francia) se estima en 500,000 los que padecen dicha deformidad. En San Juan vá desapareciendo al extremo de ser raro encontrar de estos individuos. En San Luis se le vé escepcionalmente. El contraste que ofrecen las Provincias de Cuyo es notable; muy frecuente la endemia en Mendoza, casi nula en una y nula en la otra, siendo así que en todas ellas se encuentra la influencia de la altitud, la vegetación, las aguas abundantes y hasta la ausencia de elementos extranjeros en una población, cuya mezcla con el nacional daría por resultado una modificación en el tipo, que será favorable á la extinción de la enfermedad, por cuanto produciría enjendros menos aptos para su desarrollo. En cambio, al norte de la república el bócio asume proporciones alarmantes, y en Guachipas ni el cura ha escapado á su invasión. En Tucumán se le encuentra preferentemente en la capital (al sur) y en sus alrededores: Tafí, San Javier, Yerba Buena. Además se le vé en Lules, Faimallá, Monteros con frecuencia, como así mismo en Trancas, San Pedro de Colalao, Graneros, Chicligasta y Río Chico. En la zona correspondiente á los valles Calchaquíes no se ha observado la enfermedad. La Provincia de Salta tiene regiones donde el bocio constituye un verdadero azote y su mayor contingente lo suministran los departamentos de la Capital, Cerrillos, Caldera, Chicoana, Rosario de Lerma, Guachipas y Campo Santo, es decir que es la comarca comprendida en el Valle de Lerma la que más tributo paga á la endemia, existiendo algunas de estas poblaciones donde la mitad de sus habitantes la padecen como Calderilla, por ejemplo. Güemes y Santa Rosa son fuertemente atacados.

La ciudad ofrece numerosos ejemplares diseminados en todas las esferas sociales: y á estar á lo referido por el Dr. Niño, esta enfermedad no remonta aquí á épocas lejanas, sino que es de data reciente comparada con la antigüedad que ella

tiene en el resto del territorio. Y en su concepto hay que buscar la explicación en modificaciones que se han producido en las aguas del Río Arias, de las que se surte la población. Segun el Dr. Niño, este río, á consecuencia de crecientes anteriores, ha engrosado su caudal con las aguas del de la Silleta, que, abandonando su cauce vino á confundirse con el anterior; desde entonces el coto hizo su aparición en la capital. No hay duda al respecto, pues en la epidemia de cólera de 1886–87 se pudo comprobar que, con motivo de usar los habitantes el agua hervida, los bócios disminuyeron de volúmen, al mismo tiempo que las fiebres intermitentes dieron tregua á sus invasiones. De esto se deduce fácilmente que el último de estos ríos contiene algún principio ó gérmen mórbido que por su acción sobre el organismo produce la endemia. Y da más valor á esta hipótesis el hecho averiguado de que los más acabados ejemplares de bócio los produce la sección de la Silleta. Corresponde pues averiguar la composición de las aguas del río de este nombre, hacer su exámen bacteriológico para encontrar en ellas el origen ó causa de la endemia. Si el hecho anotado es evidente, como lo suponemos, y si es cierto que ántes de confundir sus aguas los mencionados ríos no se conocía en la ciudad de Salta la enfermedad en cuestión, resalta la urgente necesidad de buscar en las del primero y en las tierras que cruzan, las causas del mal.

La bacteriología tiene que ilustrar el punto, y es ella la única que podrá decidir en última instancia con verdadero criterio fundado en la demostración práctica, la verdad de estas apreciaciones que hoy por hoy tienen para nosotros mucho de positivo. En la Provincia de Jujuy se encuentra el bócio en los departamentos siguientes: San Pedro, Perico, parte meridional del Valle Grande y Ledesma, siendo el último el más atacado. Resulta que la enfermedad reina en las poblaciones inmediatas al Río Grande. Se ha comprobado una marcada tendencia á disminuir. En la Provincia de Catamarca, la región bociosa, la componen la capital, Piedra Blanca y Poman, en el último de los cuales desaparece el río Belén. Los otros dos departamentos están regados por el río del Valle que muere en Capallán. Andalgalá y Belén son también muy visitados por la endemia. El Dr. de la Vega piensa que la consanguinidad es un factor importante que entra en la etiología del bócio en esta Provincia (Catamarca).

La proporción entre hombres y mujeres bociosas es de 1 de los primeros por 10 de las segundas. En la mujer que no ha tenido hijos su marcha es lenta, en tanto que en la multípara es bastante rápida.

Se ha notado hácia el sur del Valle de Catamarca, en el borde del gran Rio Salinas, que en varias estancias existen pozos cuyas aguas, ligeramente saladas, tienen la propiedad de hacer desaparecer la hipertrofia de la glándula tiroides después de algunos meses de uso, y con tal de que esta no sea muy considerable. Se supone que estas aguas contienen iodo y bromo, pero ningún análisis sériamente practicado ha puesto de manifiesto la presencia de estos metaloides. En la Provincia de la Rioja, solo en un pequeño pueblo del Departamento de Chilecito, en un fondo de valle y cuyas aguas son como la mayor parte como las de la región calcarea, se vé el coto y con frecuencia. Existen en ese punto familias enteras de cotudos que se entrelazan con individuos de otras también cotudos, dando frutos de la misma clase. Hay que agregar que familias que han ido á vivir en ese paraje han permanecido inmunes y lo mismo sus hijos, lo que podría ser un argumento en favor de la herencia, si hechos bien comprobados no demostrasen que individuos libres de toda herencia son víctimas de la endemia, lo que es de observación corriente. La disminución de la hipertrofia de la glándula tiroides con la salida del paciente del punto y su nuevo aumento con el regreso á dicho paraje, ha sido igualmente objeto de sérias investigaciones que así lo han demostrado.

El bocio ataca á los animales; y así se ha visto en Tucumán perros y caballos con esta deformidad. Reduciendo su frecuencia en la República Argentina bajo la forma de un cuadro, según los datos del censo de 1869, resulta:

Provincias.	Altura sobre el nivel del mar.	Número de bociosos.	Provincias.	Altura sobre el nivel del mar.	Número de bociosos.
Buenos Aires	15	38	Mendoza	777	1,712
Sante Fé	20	18	San Juan	704	64
Entre Rios	62	69	Rioja	784	136
Corrientes	55	244	Catamarca	531	222
Córdoba	416	135	Tucuman	450	605
Santiago del Estero	162	47	Salta	1,115	1,150
San Luis	766	58	Jujuy	1,227	535

Del total de bociosos corresponden: 1,701 al sexo masculino y 3,500 al femenino. Tales son los datos en que se fundan nuestras apreciaciones; pero hay que hacer constar que hoy el bócio desaparece notablemente en muchas provincias, si bien se conserva en otras. En Tucumán, donde en épocas anteriores era acompañado de cretinismo y que obligó á la población á abandonar su asiento sobre el río del Pueblo Viejo por el que actualmente ocupa, se comprueba su disminución. En Jujuy disminuye igualmente, y esto es debido en mucha parte á las epidemias de viruelas que azotan amenudo á los indios. Además, influyen para producir este buen resultado el mayor cuidado que la gente pone en el aseo corporal, en la difusión de los conocimientos higiénicos que previenen las enfermedades y también en la mezcla de la población con individuos llegados de diferentes regiones.

Faltan observaciones que demuestren el tiempo necesario para el desarrollo del bocio en nuestro país pero se sabe que algunas fuentes del viejo mundo lo dan en 15 días, y que la residencia en puntos frecuentados por la endemia puede producirlo en algunas semanas particularmente en individuos no aclimatados. Y á este respecto cita Bordier los hechos siguientes: En Clermont, en 1851 sobre 5,635 soldados hubo 180 bociosos; en 1874 en Saint Étienne, sobre 1,400 hombres, 280 la contrajeron; en Colmar en 1864 sobre 600 individuos 107 fueron atacados, y en Annecy hubo 128 sobre 682 personas.

Haremos ahora algunas consideraciones sobre ese estado que acompaña frecuentemente al bócio, el cretinismo, verdadera degeneración de la especie, último término adonde llegan las consecuencias de la endemia. Etiolójicamente considerada, la degeneración reconoce como factores principales el clima, el suelo, la alimentación, las enfermedades, y se deben citar también las causas sociales, los matrimonios consanguineos, la falta de intercambio con individuos de otros pueblos y otras razas, para producir la renovación del tipo y darle nuevas aptitudes. Todas estas causas son bien conocidas y sus efectos bien determinados para que las expongamos detenidamente. Pero conviene recordar que los climas obran distintamente sobre el organismo, lo impresionan de manera desfavorable muchas veces, y lo predisponen á los padecimientos. El brasilero se queja de frío en el verano de Buenos Aires, con nuestra elevada temperatura; y mientras el invierno es aquí muy crudo, el Paraguay ofrece agradable y templada atmósfera. El invierno en Chile es tan fuerte que obliga á los individuos á hacer uso excesivo de los alcohólicos, y de ahí la crecida cantidad de hepáticos que ofrece la patología de nuestros vecinos. El clima del norte de la República Argentina impresiona mal al forastero, y le invade el chucho; y si tenemos localidades como Rosario de la Frontera y Puente del Inca muy apropiadas para la cura del reumatismo, y Cosquín, Mendoza y Luján,[1] puntos especiales para residencia de tuberculosos, lo cual se dice también de Corrientes, en cambio Buenos Aires ofrece ancho campo á estas enfermedades y ataca gran número, sin olvidar por eso la fiebre tifoidea, la difteria y otras que están radicadas en nuestra capital.

Hemos dicho que el bocio y el cretinismo tienen estrechas relaciones, como que el segundo es un estado que obedece á causas de degeneración que obran crono-

[1] Lujan, Provincia de Buenos Aires.

lógicamente encadenando sus desastrosos efectos que se trasmiten por herencia, y cuyo comienzo se encuentra en el primero de aquellos como manifestación patológica. Y esa relación es tan evidente que no escapa á la observación vulgar. La Provincia de Mendoza, con su enorme cantidad de bociosos, ofrece crecido número de cretinos (talvez 100), particularmente en San Vicente. Y si bien en las regiones donde el bocio reina entre nosotros se comprueban todas las formas, es la benigna la más común. Es absolutamente imposible presentar datos exactos, siendo el censo de 1869 el último que se practicó, se comprende que hoy se carece de base fija para apreciar los hechos. Sin embargo, hemos querido dar una idea al respecto, consignando lo que se sabe sobre el particular. En Bolivia abunda el bocio. La región oriental es la que más favorecida es por la endemia, especialmente la parte comprendida entre el Río Grande y Santa Cruz. En el Sud, es Tarija la más atacada, al extremo de que en los puntos elevados que ocupan considerable extensión de la zona más poblada del país como son Potosí, Sucre, La Paz, Cochabamba, etc., el calificativo de tarijeño es sinónimo de cotudo, lo mismo que hemos visto que ocurre entre nosotros con los cotudos de San Vicente (Mendoza) llamados por equivalente vicentinos. Todos los valles son centros de producción de la endemia; en las mecetas ó altiplanicies es desconocida, pero la contraen los individuos que habitando en ellas descienden á las vegas. Los naturales del país atribuyen el orígen de la enfermedad á un árbol denominado Alizo, que crece en las orillas de los ríos, y es común entre los indios y gentes del pueblo la suposición de que cuando se inclinan para beber en dichos ríos, si el árbol les dirije la palabra, quedan ya condenados á arrostrar las consecuencias de la afección.

Se ha observado que en la ciudad de Sucre, adonde antes no había coto se le encuentra hoy, y su presencia ha coincidido con un estado particular de las cañerías de barro por donde corren las aguas de consumo. Estas cañerías se han encontrado sucias, con depósito de materia orgánica. En el Perú, en la hoya de Vilcamayo, es endémico el bocio; y el cretinismo lo acompaña amenudo. En el Paraguay es frecuente igualmente el coto, sobretodo en Villa Rica; y en la Asunción se le encuentra en todas las clases sociales, siendo de advertir que tal vez estos cotudos procedan de la campaña. En México existe en el Pueblo de Santiago Tuxtla, Huichapán, Huejutla, Michoacán, Guerrero y Sinaloa.

No queremos terminar sin hacer mención de las opiniones manifestadas últimamente en el Congreso de la "Association française pour l'avancement des sciences" (session de Pau, 21 septembre 1892) en el que Chopinet (de Lérouville) ha expuesto sus ideas sobre esta cuestión y presentado las siguientes conclusiones:

(1) Es en el fondo de los valles, en la proximidad de los arroyos que se observan casi esclusivamente estos dos síntomas de una misma enfermedad (bocio y cretinismo). (2) La endemia crece de intensidad, desde el origen de los valles á los últimos contrafuertes de la cadena. (Pirineos.) (3) La endemia tiende á atenuarse de una manera general; ha desaparecido de varias localidades en otro tiempo muy afectadas. Este retroceso de la enfermedad no puede atribuirse á un cambio en la naturaleza de las aguas de bebida, sino á los progresos del confort y de la higiene general. (4) En la constitución geológica del suelo, los sitios esquistosos gozan incontestablemente un rol perjudicial. (5) Las causas muy numerosas del cretinismo y del bocio son en los Pirineos, la humedad y la suciedad de las casas, la falta de aereación y de luz solar, la mala alimentación. (6) En los Pirineos, no hay sino la doctrina de las causas múltiples del bocio, que no sea desmentida por los hechos.

En el mismo congreso, Gils ha referido el origen de esta enfermedad á un microorganismo, diciendo que puesto que ella ha podido aparecer momentáneamente y desaparecer en seguida en medios en que antes era desconocida, es lógico atribuir su causa á un principio viviente, susceptible de adquirir y de perder su carácter

nocivo; con lo que el bocio entraría así en la clase general de enfermedades producidas por micro-organismos y podría bajo ciertas influencias extenderse y propagarse por la invasión de estos.

Las cuestiones de terreno ó de composición de las aguas en los países de bocio se reducirían según Gils á una cuestión de medio de cultura, propio al desarrollo del micro-organismo; y en estas condiciones la afección no aparece más como fatalmente inherente á una región, y que sólo puede modificar una revolución geológica sino más bien una infección de medio, de la cual la higiene debe triunfar. La teoría microbiana aplicada á la etiología del bocio gana terreno y se confirman así las previsiones de Arnould.

RESÚMEN.

(1) El bocio es endémico en muchos países de la América del Sud. (2) La causa de la endemia es un micro-organismo, según las últimas investigaciones. (3) Los elementos del suelo en las regiones de bocio, deben ser convenientemente estudiados. (4) En la República Argentina, el bocio es endémico en las provincias montañosas pero en algunas de estas mismas va desapareciendo. (5) En la provincia de Corrientes, en la parte sobre el alto Uruguay, regiones de llanura, también se le encuentra entre los naturales, aunque no es abundante. (6) En las Provincias de San Luis y San Juan, disminuye notablemente; y en Mendoza, en las mismas condiciones que estas, su frecuencia es muy crecida. (7) En Salta también es muy frecuente. (8) Hay fundamento para suponer que en la República Argentina el bocio tiende á extinguirse en los focos donde hoy la población se mezcla con otras razas y otros tipos. La influencia del intercambio de la sangre parece evidente.

A BRIEF CONSIDERATION OF ELEPHANTIASIS ARABUM AS OBSERVED IN THE SAMOAN ISLANDS.

By JOHN C. WISE, M. D., Surgeon U. S. Navy.

While this disease does not present itself for the practical study of the medical profession from a scientific and humanitarian standpoint, it must claim our attention. The nomenclature and etiology are involved in a myth of terms and theories insomuch that any contribution in that direction would seem desirable. Aitken long ago deplored the tendency to give to the same pathological condition names varying with the locality or based on some anatomical feature. Much of this is unavoidable, much might be obviated, but until pathology is more exact pathological conditions will continue to be inexactly named. The disease under consideration has been known as "Barbadoes leg," "Egyptian sarcocele," "lèpre tuberculeuse éléphantine," "hernie charnue," "elephas pachydermia," "bucnemia," "hypersarcosis," "febris erysipelatosa," and "elephantiasis crusis." The earlier name is probably the best, having at least the negative advantage of giving no erroneous theory as to the nature of the malady. Elephantiasis Arabum is a constitutional disease characterized by paroxysmal fever, erysipelatous and hypertrophic inflammation of the skin; at first local, but invariably progressive. The condition is attended by the presence of a nematoid in the blood, probably the filaria sanguinis hominis. The êtiology of elephantiasis is still *sub judice*. It is par excellence a disease of hot and damp climates; humidity and heat being the most important factors in its production. The inhabitants of islands and the seacoast are the chief sufferers, and it has been argued from this that a fish diet causes elephantiasis. Inasmuch as the majority of the insular population do not suffer, this proposition can not be accepted. Furthermore, the Samoan islanders are inexpert fishermen, and fish forms a small part of the diet, yet the number of cases in the islands is unu-

sually large. Common to both sexes, the disease occurs much more frequently in the male, and is unusual in interiors. The dark races are its victims, and it has been asserted that no case occurring in a person of unmixed white blood has been noted. This statement is an error. At Samoa a Swede, resident of the islands since the American civil war, had well-marked initial hypertrophic disease; but most of the whites attacked have a strain of native blood. The white race escapes in virtue of non-heredity and an entire difference in the mode of life. The strongest evidence of race and climatic influence is afforded by the fact that the disease in its earlier stages can be eradicated by removal from the endemic locality. There is an undoubted hereditary influence, and mildly contagious characters are probable. Of 737 cases reported by Richardson, 236 had one or both parents affected. Of two families living under the same conditions and in proximity, one has the disease and the other is immune. If we consider the manner of Samoan life, many persons sleeping on the same mat, and all eating from one bowl, and further, if we reflect on the prevalence of ulcers other than elephantine, and the secretions from the skin of those who do suffer, we must conclude that most facile conditions for contagion exist. The most diverse evidence is offered as to the influence of malaria. Osgood (Foochow) states that in 57 cases a malarial history was traced in all. Heffinger (U. S. Navy), on the other hand, calls attention to the fact that in Samoa, where elephantiasis is endemic, malarial fevers are never seen, and his observations are sustained by other naval medical writers. There can be no doubt that secondary and local causes are more important than has hitherto been supposed. Heffinger (U. S. Navy) attributes much influence to the custom of sitting and sleeping on the damp floors of the native houses. The writer observed in all cases occurring in the lower extremities that the soles of the feet were deeply cracked and ulcerated, the result of walking barefoot along the stony shores and pathways. Over 50 per cent of the islanders are so afflicted, and it is in their belief a cause of hypertrophic disease. A Swiss resident in the islands since the American civil war had well-marked evidence of commencing disease, which he felt assured he could combat successfully if furnished with shoes. A half-caste (Tahitian-English) informed me that his case commenced with wounds of the feet. It is probably not in the remote future when scientific methods applied to the study of this disease will reveal its true nature. Richardson (British India), 1877, discovered two living specimens of filariæ in the diseased tissue of a Bengalese suffering from scrotal elephantiasis. Bancroft (England) later found filariæ in the lymphatic abscess of the arm associated with embryonic filaria in the blood. There is an unascertained relation between these discoveries and those of Bilharz (at Cairo) in 1851, of Wacherer (Bahia) in 1861, and of Crevaux (French Navy) in 1870, who found nematoidea in the urine of a creole suffering from chylous hæmaturia. Lewis has traced the filariæ to the blood in fifteen instances, each suffering from chyluria or some kindred affection. It is probable that the non-venereal adenitis of Samoa is of this origin. These nematoidea entering the blood and later the lymphatics, predispose to inflammatory changes in the latter system. Agnew (*op. cit.*) observes that the most plausible view of the disease is that which regards it as a lymphangeitis. Authorities have variously attributed the diseased condition to an inflammation of the arteries, veins, lymphatics, and skin. In an advanced case there is an involvement of all these parts. Observations of 100 cases in Samoa affecting the lower extremities showed lesions of the feet followed by inflammation of the lymphatic vessels. Virchow has called attention to the lymphatic vessels especially, and considers the hypertrophy due to this vascular hyperplasia; the veins and arteries become involved secondarily, the lymph spaces are engorged, the meshes of the areolar tissue are filled with plastic exudates, the normal elements of the part take on increased activity, a dermatitis is set up, and the absorbents unable to remove the extensive deposits, enormous

edema and hypertrophy result. In the earlier cases in many instances the red line of the inflamed vessel may be noted, while later they become knotted and corded. Clinically, the following features are noted: There is pain, heat, redness, and all the signs of inflammation; often this condition is found along the course of the lymphatics. Preceding or accompanying this local manifestation there are fever and general disturbance, varying greatly in severity. Elephantiasis as observed in Samoa is peculiar in the absence in a majority of cases of general symptoms, the local condition being painless, though rapidly progressive. In cases where it occurs the fever and general symptoms subside to return again and again, leaving the tissues more swollen and indurated after each attack; eventually a chronic inflammation of the skin and cellular tissue results, and hypertrophic changes progress rapidly. The skin, enormously infiltrated, disposes itself in overlapping folds, the papillæ are enormously enlarged, forming a verrucose variety, or eminences of a tuber-like shape, elephantiasis tuberculosa; the vascular coats being involved, a nævoid variety results. The overcharged skin is in a moist or weeping condition and a lymph-like fluid escapes. Pain is not a late symptom, anæsthetic symptoms then prevailing. Often the inflamed lymphatic glands enlarge and break down in ulcerous masses. A systemic condition followed by local irritation, affecting primarily and principally the lymphatics, are thus the essential features of this disease. Little of value can be said as to treatment. The natives practice a rude massage, and are aware of the benefits arising from protection of the feet and the uses of compression. In an intelligent half-caste good results quickly followed the use of an iodine liniment and compression by a roller where the part affected was in the lower extremities.

The Samoan Islands have been considered a center of dispersion for the population of the Pacific, and inasmuch as the natural disposition is to the contrary the theory seems well founded. We are aware that the strongest arguments in favor of the descent of our American Indian from Asiatic ancestors rests on the fact of Japanese canoes having been found on the west coast of North America, carried thither by the "Kuro-Siwo" or Black Stream of Japan. Now, in the region we are considering, that is, from 30° south to 30° north of the equator, the conditions are all unfavorable to migration from east to west. Not only does a strong equatorial current prevail, but the trade winds are a powerful impediment to even steam navigation. Winds do change for a period, a kona or southeast wind prevailing at times for weeks, alternating with calms, and it must have been in these intermissions that migrations from the eastern to western islands were feasible. Canoes have recently been found wrecked in Kauii, a northern island of the Hawaiian group. The Samoan belongs to the Maori branch of the Malayan family, the islands having probably been peopled from Australia, and from Samoa the islands to windward have received their earliest settlers. It is easy to establish a relation between the Samoan and Hawaiian from the language and customs alone, which are closely allied. The life history of these two groups, the Samoan and Sandwich (Hawaiian) islands, is a most interesting problem. Of the same origin, inhabiting insular homes, much alike in climate and production, why has the one maintained itself and the other almost perished? It would seem to be but an illustration of the law that when the white and dark races are in continued contact the latter sooner or later succumbs. Cook estimated the Hawaiian people at 300,000, a rude estimate, of course. But those who till the uplands of Hawaii to-day to plant their coffee come upon the foundations of what were extensive villages. The census of 1832 gives a population of 130,315; the last one gives 47,508, while to-day it is believed there are not over 25,000 islanders. It is believed that in another quarter of a century this people will have entirely disappeared. Cook's crews and those of successive voyagers implanted syphilis; leprosy was brought in from China; later, epidemics of smallpox and measles of unusual virulence rav-

aged the islands. The introduction of alcoholic liquors was a serious cause of national decay. From all accounts the Hawaiians were at all times highly immoral; polygamy, polyandry, abortion, and infanticide were natural vices. But these factors were more than counterbalanced by the vigor of the race in Cook's time. He found them of fine physical proportions, amiable, but given to war and gymnastic sport. The Samoan people were fortunate in being out of the route of trade. Unlike the Hawaiian islands, the Samoan group was rarely visited, and only in our day is a knowledge of the people being obtained. These facts and an unusual chastity observed by the women in their relation to foreigners has so far preserved them. Yet about Apia, where the whites are increasing, the natives are, on the contrary, diminishing. Statistics of the group are wholly unreliable. In 1840 the population was given as 56,000; in 1870, 35,000; in 1880, 30,000. There can be no doubt that the constant tribal warfare, fomented and continued by foreign interference, has prevented a growth which the vigor of the race would justify. The tax-gatherers of King Laupepa, sent from Opolu to the other islands, had no knowledge of the number of the King's debtors. The birth rate is high and there is a great love of children among the Samoans. With peace and non-interference the race would be physically a prosperous one.

ON SOME PECULIAR DISEASES ENCOUNTERED IN NAVAL CRUISING AND RECENT OBSERVATIONS ON HAWAIIAN LEPROSY.

By GEORGE W. WOODS, M. D.,

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In these days of almost perfect hygienic surroundings on board an American man-of-war—the issuing of rations which could scarcely be improved, embracing fresh provisions, either canned or supplied from local markets, furnished in abundance and variety, the use of distilled water or that of undoubted potability, the careful medical supervision of our crews both ashore and afloat with reference to diet, clothing, and climatic or morbific exposure—we have few diseases introduced on board ship, and those which are embraced under the title of strictly demographic diseases and distinct from climatic are practically unknown as affecting our officers and enlisted men. But though thus defended from contagion or the action of demographic influences, the diseases peculiar to the countries visited by our ships on foreign stations have been made a subject of earnest study by the medical officers of our own and other navies, while their investigation and practice have been productive of marked results by adding to the sum of knowledge of obscure and recondite disease and in the extension of philanthropic care to sufferers in the far-away coasts and islands reached by our ships, where no intelligent and skillful attention is otherwise to be obtained. Notably is this the case in the matter of elephantiasis, so common in many of the Pacific islands, where hundreds have obtained relief through operations performed by naval surgeons. I propose in this brief paper to describe two curious affections peculiar to the Asiatic continent and islands, being rarely, if ever, encountered on our own continent or in Europe—and, if so, having an exotic origin—to which will be added some notes on leprosy, the knowledge of which is sufficiently universal not to demand a didactic description. All of these diseases have their origin or persistent existence in local conditions, so that, though we may not clearly determine their etiology the term demographic seems to be applied with distinct propriety. The first of these diseases is the so-called "parangi," or Spanish pox, which is only known in Ceylon, and has been most carefully studied and reported on by Dr. Kynsey, of the civil service, and came under my observation during a cruise in

the U. S. S. *Juniata* in the year 1883, this description having been embodied in my report of that cruise. The second is psilosis, or sprue, observed on the same cruise in the ports of China.

THE PARANGI DISEASE.

The Spanish pox is a disease found in every district of Ceylon, but more especially in the southern districts, where, in 1879, 6,758 cases existed, and throughout the island 10,305. In the vicinity of Colombo it is not often encountered. Parangi seems to have been known from ancient times, but after the introduction of syphilis and other foreign affections characterized by eruption its diagnosis became confused. It bears a striking resemblance to yaws, is not unlike pellagra, and is easily confounded with the syphilitic eruptions, yet it seems to have distinctive diagnostic signs. The etiology of the disease is by no means established, but official inquiry points to insufficient and innutritious food, the absence of meat, the substitution forrice of a poor grain known as kurrakan, filthy habits and surroundings, and the drinking of impure water from nearly exhausted tanks—artificial lakes—where cattle wallow through the day. Microscopic examination has thus far discovered no bacillus or determined any peculiar condition of the blood or secretions. The disease is undoubtedly contagious, and the weight of evidence seems to prove that it is not hereditary or transmitted through natural secretions. All are subject to the disease, but absolute contact of discharges is required, not necessarily an abraded surface, for its propagation. It is only, however, in the debilitated that its worst forms are manifested, and only in those cases does it seem to affect longevity or even the general health. Once cured, a recurrence of the disease is doubtful. Parangi is divided by Dr. Kynsey into three varieties and four stages. The symptoms are thus described by Mr. Garwin, M. B.:

Primarily there is a stage varying from two weeks to three months, during which period an ulcer forms over some bony prominence, generally caused by scratching the part. While this ulcer is healing the second stage declares itself as a slight pyrexia, accompanied by a feeling of debility and general malaise, with articular pains of a dull, shooting character, lasting from two to eight days and terminating in the third stage, that of eruption. The eruption occurs in successive crops, first on the face, then on the trunk and extremities, and not infrequently on the fauces, soft palate, and tongue. It is quite characteristic, though sometimes it becomes confluent in the axilla, nates, and groin, when its distinct features are lost. A papule similar to that of acne first appears, and undergoes various changes which serve to diagnosticate its varieties. In the first and mildest variety of the disease the papule assumes a yellow tinge, loses its prominence, and heals in one direction while extending in the other. In this there is no loss of substance, no discharge, and only a slight desquamation in healing. In the second and third varieties the papule increases to the size of a pea, or larger, becomes very prominent, and its apex roughened from degeneration of epithelium. A gluey matter exudes, forming a crust. The papule shrinks and acquires a brownish-yellow hue, a crack or fissure surrounding its base. It resembles rupia, but the crust is less conical, cockle-shaped and stratified. The third variety is a sequel of this, in those patients who are greatly debilitated, or where the parts have been submitted to friction. Then the exudation is excessive, the papule becomes greatly enlarged, pus forms abundantly and oozes out from beneath the dirty, yellow, soft crust, which is constantly being removed as quickly as it is formed, presenting a condition not unlike that of condylomata. When about to heal the rupial crusts fall off, leaving a clean, granulating surface, appearing like a ripe raspberry, or the crusts may dry up and fall off, exposing a surface already healed. In the condylomatous form healing takes place as in ordinary ulcerations, and in all

cases the resulting cicatrix is invariably deeply pigmented, the natural hue of the skin not being acquired for many months. In rare cases parangi goes on to a fourth stage, which has been attributed to the abuse of mercury. This is characterized by great debility and emaciation, anorexia, extension of the eruption, unhealthy ulceration, with profuse discharge, destruction of the true skin, and excessive deformity, if the patient recovers, through the contraction of cicatrices. When the eruption occurs on the soles of the feet it is termed dumas. In those cases the hard cuticle is distended until it bursts, the pain being excessive, and the eruption appears as a fungous growth, covered with a yellow scab. Early writers on parangi have considered the disease to be a form of syphilis, but this has been completely disproved by the careful consideration lately given to the subject, and the same investigation has proven that it is not a form of leprosy, pellagra, or yaws, but a disease *sui generis*. From syphilis it is distinguished by the absence of the ordinary signs of that affection when it is a disease of inheritance; and where the osseous system is affected in parangi it is always due to the abuse of mercury and does not properly belong to the history of the disease. The character of the eruption sufficiently distinguishes it from lupus; from leprosy it is easily diagnosticated by the absence of the enlarged ear lobes and the characteristic anæsthesia. To framboesia or yaws it bears a striking resemblance, and in the condition known as dumas the same raspberry-like growth is produced. Many still think it to be framboesia modified by climatic influences. The prognosis is always favorable, save in cases which are in the fourth stage. Convalescence is readily established in the first variety, while in the more chronic cases there is little suffering, trifling disturbance of the general health, and ultimate recovery. The treatment is dietetic and medicinal. Under the first head good, nitrogenous food, milk, cod-liver oil, and ferruginous preparations should be ordered in all cases indicating malnutrition. Under the second head the treatment varies with the stage of the disease. In the febrile stage warm baths, diuretics and diaphoretics, saline cathartics, as sulphur and potass. bitart., are ordered. In the eruptive stage mercury is of use, but must be carefully administered, preferably in combination with potass. iodid. Much harm has been done by this drug in the hands of the native vedaralas. For the flying pains the iodide and bromide of potassium in combination are recommended. In this stage arsenic is of use, and the potass. bitart. and sulphur should be continued. Locally, ointment of acid carbolic is applied, and the fungus growth of dumas is destroyed with nitric acid. The warm bath, with soap, should be used daily. The more extensive and intractable ulcerations, lesions of the bones, and abscesses, due to the abuse of mercury in the hands of the native quacks, are best treated by potass. iodid. Locally, stimulating applications are found useful, such as strong tincture of iodine, carbolic-acid lotions, turpentine liniment, etc. If the cicatrix is dense it may be separated by an incision, or even excised. Other conditions are treated on general principles. Hospitals have been established throughout the districts where parangi prevails, and every attention is given to the afflicted. The disease, however, must exist so long as there is poverty, defective agriculture, water tanks of insufficient capacity, and general hygienic surroundings of the worst character. As regards inoculation, which is employed to acquire yaws in the West Indies, no reports have as yet been made by the medical officers of Ceylon, though instructed to employ it. In the reports for the year 1871, however, Mr. W. D. Wright makes the following allusion to a custom prevalent in remote parts of the Vanori district. This custom is—

To make children, when they are about 1 year old, partake of rice off a leaf or plate on which a person suffering from the disease has eaten. In a short time pustules appear, resembling itch, on the child's body, and then medicines containing a minute portion of mercury are administered, which cause the pustules to

dry up in seven days, the scales to fall off, leaving deep marks, which, in course of time, disappear. It is said that this is an almost certain prophylactic, and that though the disease may attack one who has been so guarded, the effects are never serious.

PSILOSIS, OR SPRUE.

The term "psilosis" is one of recent application to this remarkable disease, but under the name of sprue it has been recognized and observed by all travelers in India, especially in the highlands, in China, its adjacent southern territory, and Java, for a considerable period, being especially studied in the latter island by physicians in the service of the Dutch East India Company, and more recently by those in the Chinese customs, as well as the medical officers of the English diplomatic service, resident in the Chinese ports. In all these countries it has been frequently confused with tropical diarrhœa, muco-enteritis and other forms of intestinal disorder, hepatic irregularity, and stomatitis, but more careful and extended observation has determined it to be a disease *sui generis*, having distinctive diagnostic features and a specific origin, though not traceable to any specially demonstrated microörganism though with our present tendency to interpret the etiology of disease, this is naturally assumed to be the case.

Definition, etiology, and pathology.—Psilosis is a disease of tropical or semi-tropical countries, affecting foreigners rather than natives, of insidious approach and chronic remittent continuance, characterized by superficial ulceration of the buccal cavity, tongue, and alimentary canal, salivation, diarrhœa, or irregularity of the bowels, anæmia, and profound debility, disproportionate to the amount and character of the discharges, and atrophy of the muscular and fibrous tissues, which, with the anæmic pallor, gives to the skin a shrunken, aged, deathly appearance—a disease which is at once favorably influenced by change of climate, but, when apparently cured, has a tendency to recur, even in other lands, after the lapse of years, when the patient is exposed to unfavorable climatic and hygienic conditions. As regards cause, we can not as yet go beyond the predisposing condition, which is the want of adaptability of certain constituted foreigners to peculiar climatic surroundings, and the prolonged high temperature of southern Asiatic countries, which, with many observers, is assumed to be the entire pathology of the disease, and, as an exciting cause, accidental, operative, and traumatic conditions, especially those involving the alimentary canal, have been recorded. It is, however, a disease so distinct in its character, that it is more likely to have its origin in some special microbe or parasite which has thus far eluded microscopic investigation. The soft, colorless masses of which the stools are frequently composed are found crowded with bacilli and various forms of cell life, which have been submitted to study, but the special association of any one of these with this disease alone has not been determined. The few necropsies that have been carefully made report an atrophy and ulceration of the mucous membrane of the intestines, but especially the ileum, with a generally normal condition of the liver and pancreas, though the liver is sometimes atrophied, and the pancreas has been found in a state of degeneration, and even with abscess. Beyond these no important changes have been revealed by autopsic observation. The most marked pathological features are the peculiar stomatitis, the salivation, acidity of the stomach and alimentary canal, feeble gastric digestion, with a special acid condition of the contents of the ileum—where the reaction is usually alkaline—and it is here that the coloring matter of the fæces is supposed to be destroyed by bacterial action, or it may be due to the state of hyper-acidity. The stools show some absorption of the fat of milk, which is the most usual form of food in this disease, but most of it is passed from the bowels, the fæcal mass being highly acid. One remarkable effect of the intestinal condition is the effect upon any preparation of iron which may be administered, the metal appearing in fine particles, and the fæces not blackened.

Clinical description.—Psilosis, or sprue, appears as a stomatitis, or inflammation of the alimentary canal, and its starting point may be the mouth, stomach, or intestines. The disease has a chronic course, is generally of a remittent character, with periods of almost complete convalescence through a prolonged state of malaise and general debility. The tongue is generally clean, but may be slightly furred, very red, and fissured, the papillæ enlarged and highly sensitive, especially at the tip and edges. The whole buccal mucous surface is swollen and congested, often raw and tender, generally covered with excoriations, perhaps ulcerated, with the gums swollen and bleeding. The salivation is often so profuse as to overflow the lips, creating great discomfort by the constant necessity of swallowing, and deglutition is very difficult and painful, from the condition of the mucous membrane of the mouth being extended into the fauces, œsophagus, and stomach, highly seasoned food and condiments causing absolute agony, while only the blandest food can be ingested. Diarrhœa, with frothy acid evacuations and even choleraic discharges, is usually present, though this may not be the case; but all stools are characterized by being clay-colored or entirely colorless. There is commonly a constant sense of emptiness in the epigastrium. At intervals of several days these symptoms usually abate, when the tongue contracts, the papillæ diminish, its upper surface appearing clean and glazed, as though varnished, the oversecretion of saliva diminishes or ceases, while the diarrhœa is modified, through the condition of the discharge is not greatly changed, and thus a fair convalescence may be established. To this an exacerbation succeeds, and may come on with regularity every two or three weeks, and sometimes at intervals of a few days, the lingual, buccal, and salivary symptoms returning, and now the superficial ulceration recurs or becomes more extensive, with increased difficulty in deglutition and articulation. The disease thus marches rapidly toward the end, with increasing anæmia, the skin appearing ex-sanguine, the conjunctivæ and tongue assuming a yellow pallor. Emaciation also progresses, the muscular being more affected than the adipose tissue, the body becomes withered in appearance, the face is expressive of advanced age, and the debility is extreme. This condition attained, the disease must soon terminate fatally, unless the patient is rescued from his surroundings, his demographic involvement, and transferred to a different clime.

Diagnosis.—From thrush it is distinguished by the occurrence of the latter in infantile life, or as an intercurrent condition in wasting diseases of the adult and the grayish-white deposit upon the buccal and pharyngeal mucous membrane, which, under the microscope, displays the easily recognized mycoderma fungus characteristic of thrush, which is a disease responding immediately, in most instances, to proper treatment. The foul tongue and offensive breath (especially marked in the mercurial form) are diagnostic signs of ulcerative stomatitis, and there is usually but slight difficulty in tracing this inflammation to some adequate cause, while in psilosis the tongue is generally clean, fetor of the breath is not common, and neither bones nor teeth are involved. Lastly, it may be confused with tropical diarrhœa, but the absence of all color from the stools, with the pronounced acidity of the fæces, the ulcerative condition of the mouth and fauces, and the specially marked languor in sprue, with the remittent character of the disease, should be sufficient to determine the diagnosis.

Treatment.—Every therapeutic measure has been applied in psilosis, and much relief given by the ordinary remedies addressed to stomatitis and morbid conditions of the organs concerned in digestion, the emollient vegetable oils, such as olive, almond, and cotton-seed oil, being found especially valuable. These, however, have not been curative, but we seem to have in santonin a remedy of great promise, for which we are indebted to George Thin, M. D. He first used it as a vermicide and discovered that in 5-grain doses, once daily, it has in his practice

controlled the evacuations of psilosis, causing a speedy convalescence, and is apparently curative. Milk, koumiss, rice and other cereals cooked in milk, bouillon without condiments, barley and rice water, flaxseed tea, and similar bland substances must be the form of nourishment, to be given frequently, in small quantities. In a disease so fatal, and one so entirely dependent on the *entourage*, we should, however, remove the patient at once to a radically different climate, where we have the right to expect an immediate change for the better and rapid convalescence.

Of recent writers on this subject the most prominent are C. Begg, M. D., and George Thin, M. D., in the Lancet for 1892, who give an interesting and lucid description of this remarkable disease; and in the Medical Report of the Chinese Customs Service for 1880 Patrick Manson, M. D., presents a valuable paper detailing his personal experience with sprue.

LEPROSY.

For a long period leprosy, as observed in the Western Hemisphere, was confined to certain widely separated districts of South America, to the West Indies and Mexico, to a small area of the State of Louisiana, and the eastern possessions of Great Britain in North America. But within recent years it has seemed to acquire a new impetus throughout the world. The Chinese nearly sixty years ago brought it to the Hawaiian Islands, the Norwegian colonists have carried it to the great Northwest, and the extension of oriental emigration to the United States has brought with it this dread disease, so that in almost every State and Territory into which the Chinese have penetrated as laborers and servants there are reports of isolated cases which have caused the most intense apprehension lest these should prove centers of infection and leprosy become permanently established in our midst. The facts and the reports of independent observers in all lands where leprosy exists, demonstrating that we are in a period of extension of this disease, calls upon the medical profession in all lands to arouse the people and work with the Governments for its repression. To do this an accurate estimate of our existing knowledge on this subject is of paramount necessity, that we may approach as nearly as possible to a determination of its etiology, mode of extension, prophylaxis, and treatment. The views entertained on this subject by students of the disease have been so widely at variance that for the personal investigation of the leper and the collecting and sifting of evidence, under the important headings above enumerated, a British leprosy commission was organized and sent to India in 1890, which has but recently reported the result of its labors and its conclusions. The commission was composed of members of the colleges of physicians and of surgeons of London, Indian medical officers, and representatives of the "English leprosy fund." A year was spent in the investigation, 2,000 lepers were examined, and answers to carefully prepared interrogatories were received from a majority of the medical officers of the Indian civil service and the medical officers of the army. A wider or a more complete field for a harvest of knowledge can not be conceived, extended by interrogatories addressed to the other colonies and countries similarly affected, and the conclusions of the commission are thus summarized: (1) Leprosy is a disease *sui generis*; it is not a form of syphilis or tuberculosis, but has striking etiological analogies with the latter. (2) Leprosy is not diffused by hereditary transmission, and for this reason, and the established amount of sterility among lepers, the disease has a natural tendency to die out. (3) Though in a scientific classification of diseases leprosy must be regarded as contagious, and also inoculable, yet the extent to which it is propagated by these means is exceedingly small. (4) Leprosy is not directly originated by the use of any particular article of food, nor by any climatic or telluric conditions, nor by insanitary surroundings; neither does it

peculiarly affect any race or caste. (5) Leprosy is indirectly influenced by unsanitary surroundings, such as poverty, bad food, or deficient drainage or ventilation, for these, by causing a predisposition, increase the susceptibility of the individual to the disease. (6) Leprosy in the great majority of cases originates *de novo*: that is, from a sequence or concurrence of causes and conditions, dealt with in the report, and which are related to each other in ways at present imperfectly known.

In 1876 I spent a considerable period at the leper settlement of Molokai, when I made a special study of the disease under the guidance of the lamented Father Damien, who presents the most positive evidence of its contagious character under circumstances of ordinary intercourse, his deathbed confessions to a layman that "he had never known woman" outweighing the calumnious assertions of his enemies that his licentious life was the cause of his becoming a leper. Since that I have seen and studied the disease in almost every land, returning recently to Hawaii to renew my interest in leprosy as manifested in this island Kingdom. And I maintain that here it is to be studied to better advantage than in any other land similarly afflicted, its history as related to the Hawaiian people: its clinical records completely written; the question of cause, heredity, and contagion fully discussed; and segregation, with all therapeusis practiced through a long period of years by local physicians of the highest attainments and foreign physicians of eminence, including the widely celebrated Dr. Arning, of Hamburg, who have given the subject their most earnest application. Therefore the considerations of this British leprosy commission can be responded to more satisfactorily from the position of intelligent experience of those employed in the care of the leper and the strong effort that is being made to eradicate the disease in the islands of Hawaii than in any other portion of the globe where it exists, not excepting India, which was chosen for the special work of this commission. Thus prepared, it is in this manner they respond to the six paragraphs summarizing the report of the commission by six other paragraphs presenting the Hawaiian view of leprosy.

First. It is a disease *sui generis*. It is not a form of syphilis or tuberculosis, these diseases being often coëxistent with leprosy.

Second. It is not diffused by hereditary transmission, though the contrary was long maintained, and there is apparently much evidence to sustain this view; but we have to accept the opinion of Dr. Hansen, of Norway, that, being a disease dependent on the presence of a special bacillus, it can not be classed any longer as hereditary, and further, that if segregation can be properly enforced the sterility of the leper will cause the disease to die out. Segregation, however, is difficult of attainment with such a social people as the natives of Hawaii, against which they are continually arrayed, requiring the strong arm of the law, and even, as recently, the military power to enforce the law in this regard. And when collected at Molokai, the colony is invaded by Kokuas, or friendly attendants, who come and go as they please, while Kamaainas, the holders of Kuleanas, or private estates within the limits of the leper settlement, receive the lepers, and here contact takes place with the outside world, as the Kamaainas can not be disturbed lawfully, and are privileged to go where they please.

Third. It is contagious and inoculable; but Hawaiian experience compels an entire dissent to the statement that "its propagation by these means is exceedingly small," for there is every evidence that it has thus spread over the island. To quote from my own report of 1876, this has been owing mainly to the social habits of the people, viz., large families crowded together in small houses and having the same mats and blankets; the eating of poi with their fingers, all seated around and helping themselves from the same calabash; the drinking of ava in the Hawaiian manner, infused by mastication, and passing the pipe from mouth to mouth, a common Hawaiian custom. To this we may add absolute fearlessness and absence of any disgust for the disease in its worst form and the licentious habits of the race.

Finally, we may add that very rarely do we find a leper who has not acknowledged intercourse with the leprous. To sustain this position there are volumes of evidence.

Fourth. The conclusion, undoubtedly not to be controverted, that leprosy has not its origin in any particular article of food or in any climatic, telluric, or insanitary surroundings, or that it is confined to any race or caste, with the exception that a dry situation with a high temperature is favorable to staying the progress of the disease, is sustained.

Fifth. That leprosy is indirectly influenced by insanitary surroundings, poverty, and bad food is a matter of special observation in Hawaii. Dr. Trousseau states as a cause of the rapid propagation of leprosy so soon after its importation in 1840 the widespread syphilitic and scrofulous cachexia then so common in the Hawaiian race, and since then these have been the victims, as well as the very poor, and those weakened by acute or epidemic diseases, or some shock to the system under these circumstances, as by sea bathing. In all, the disease is latent for many years, it has in other countries been known to so exist for forty years, and these conditions cause its development.

Sixth. That leprosy arises *de novo*, according to the commissioners, has only to be mentioned to arouse a smile of derision, and is a most impotent conclusion to valuable work, which has rather sustained previously expressed opinions of eminent students of this disease rather than added to knowledge of the subject.

As regards prophylaxis, the commission recommended perfect hygiene and segregation, which is all that Hawaiian medical men have found from experience to be worthy of consideration; and with reference to therapeusis the same conclusion has been reached, viz., no cure; that the various oils recommended, especially chaulmoogra oil and arsenic, are palliatives, and all the other proposed remedies have proved utter failures.

My most recent notes on Hawaiian leprosy were made in the years 1890, 1891, and 1892, during which period I visited the leper settlement for the second time. And I will conclude this paper with extracts from a report then made to the bureau of medicine and surgery covering the therapeutic experiments of D. O. Lutz, M. D., of San Paula, Brazil, a former associate of Unna, of Hamburg, and a physician of large experience as a dermatologist, who was commissioned January 12, 1890, as Government physician for the study and treatment of leprosy. After consideration of the matter, he concluded to confine his work principally to Kalihi receiving station, exercising only a general supervision over medical affairs at Molokai, where Dr. Swift was in charge. At Kalihi he was to constitute one of the members of the examining board, that advantage might be had of his diagnostic ability in matters of dermatology, and he was to be permitted to retain 20 lepers for purposes of treatment and experiment. The work of Dr. Lutz really commenced November 26, 1889, and terminated October 12, 1890, when, dissensions having arisen between himself and the board, he was forced to resign. During the continuance of this service at Kalihi he had associated with him, in the care of the lepers and suspects, a competent trained nurse in the person of Sister Rose Gertrude, a young and enthusiastic English girl, whose duty was admirably performed. The period of Dr. Lutz's stay at Kalihi was but eleven months, yet several valuable quarterly reports were made by him to the board of health, and from the first and last I condense the following information: In April, after four months' experience, he speaks encouragingly, and thinks that treatment had suppressed development, especially in tuberculous cases, and, in many, absorption of tubercles, even that of the ear lobes, and disappearance of cutaneous pigmentations, so prominent a feature of the dorsal surfaces, had taken place. Syphilis was found in many cases distinctly separated from the leprous condition and yielding to specific treatment. In several anæsthetic cases, even in very unpromising ones, a partial restitution

of feeling and a diminution of contraction had been noticed, which he credits to treatment. This treatment was chaulmoogra oil and gynocardic acid, its essential constituent, with which he had had previous success in Brazil and Paris. Salol, however, was his chief remedy, first introduced by him in the treatment of leprosy several years ago. It would seem, to judge from Dr. Lutz's observations, that the progress of leprosy was associated with inflammatory conditions and febrile excitement always, and that the salol, acting as an antiphlogistic and febrifuge, stayed the morbid processes. Creosote and guaiacol, its active principle, were given in cases where there was neuralgic pain. Arsenious acid was found not to act favorably, contrary to common experience, and antisyphilitic remedies, especially potassium iodide, were not clearly beneficial in uncomplicated cases. For external use chrysarobin or chrysophanic acid was used and acted favorably in causing the absorption of tubercles and the disappearance of maculo-nervous and psoriasis-like eruptions. It also quickly improved extensive conditions of paræsthesia. Chrysarobin was employed in five-tenths per cent ointments, or in solution with either benzine, chloroform, or similar solvents, always being covered with elastic collodion. Pyrogallic acid was found to act like chrysarobin, but more slowly, and was only employed on the face and hands to avoid toxic symptoms, which are manifested as pernicious anæmia. Ichthyol is praised as combating inflammatory symptoms, and was used both internally and externally.

Dr. Lutz considered infection as furnishing the largest number of patients; heredity, if it really exists at all, as quite secondary, and vaccination as a most doubtful cause in the propagation of the disease: opinions corresponding to those of most dermatologists now engaged in the study of leprosy. In concluding his first report the following important conclusions are presented by Dr. Lutz, after many years of study and experience: Leprosy is a chronic disease and therefore requires a chronic treatment, like syphilis and tuberculosis. While in the latter disease we can not do anything more than help the natural tendency to cure, and all the methods tried in late years have led no further, still the hope survives that specifics may be found, as for syphilis. This latter disease is perfectly curable, although the moment when the cure is accomplished may never be ascertained. But we know that by watching the patient from the first, and curing every fresh outbreak by immediate treatment, we may finally come to a real cure. The stationary tubercles and nerve affections of leprosy do not endanger life, and their removal, which is often possible, does not warrant cure. It is probable that most of the microbes in the tumors are dead, and that the effect of our remedies is only to hasten the reäbsorption of the dead material. This may be obtained, perhaps, without a specific action, by an artificial irritation, and hyperæmia. But at the same time we may again throw into the circulation a few surviving organisms and thus promote new outbreaks. We must therefore direct our principal attention to the general treatment. If we learn to recognize the very first outbreak (as I have done during the last years with several patients in my private practice); if we can check it, as seems to be possible, by the use of salol and salicylate of soda; if we treat in the same way every feverish and eruptive period, giving in the intermediate time other remedies which have a favorable influence, and finally slowly remove the morbid deposits where they already exist, we do more to prolong the life of the patient than is done in all the sanitaria for tuberculosis. At the same time we may avoid at least a good deal of the consequences of the untreated cases, and make leprosy, as it has proved with most of my private patients, a rather benignant disease. I believe we shall then see cures which may be attributed, not to extraordinary fortunate chance, but to our methods of treatment.

In his final report, dated October 1, 1890, satisfaction is expressed with the effects of salol, chrysarobin, and pyrogallic acid, and reference is made to cresalol as a

substitute for salol and some experiments with sulfonal. Several patients are referred to as having improved under treatment, and five are mentioned by name as recommended for transfer from the leper to the suspect side of the hospital, presumably because they were considered to be cured of their leprosy. In October, 1890, Dr. Lutz abruptly closed his connection with Kalihi Hospital and terminated his contract with the Board of Health, Dr. Henry McGrew taking his place. On account of the confidence evinced in Dr. Lutz's course of treatment by the natives, all of his therapeutic measures were continued up to the period when the *Charleston* left Honolulu in February, 1891. At this time I was informed by Dr. McGrew that, in his opinion and that of his associates on the board, Dr. Lutz's course of treatment was not curative, and that all patients supposed to have been cured had been committed to Molokai. The Kalihi Hospital, or receiving station, where Dr. Lutz was located, is situated 3 miles from Honolulu, near the seashore and beyond the boundaries of the harbor. Here all suspects are brought, and, after inspection by the board of health, are either declared lepers and sent to the Molokai, detained for observation, or discharged. At Molokai the settlement occupies broad lands, bounded by the sea on one side and a precipitous cliff or pali on the other, and it is inconceivable how exiles could be better cared for physically, medically, morally, and mentally. Comfortable cottages have been built for all; there is a well-appointed hospital, a bountiful supply of provisions and clothing is issued to all, and for the young there are two excellent schools for boys and girls, the Bishop Home for the former and the Damien Home for the latter, both under the control of the Franciscan Sisters. There are two Catholic churches with two resident priests, successors to the lamented Father Damien, and those of other religions receive appropriate ministrations in four special places of worship. Over the settlement a resident governor rules, and a resident physician, Sidney Bourne Swift, M. D., who is a man of superior attainments and close observation, has general medical charge. But the study of the disease and of the bacillus lepræ has thus far been productive of no worthy results. The treatment employed by Dr. Lutz represents the best therapeusis of the day, and yet as good results have been obtained from careful housing, good nourishment, and the treatment of lesions and symptoms according to the principles of good pathology, which will, as previously pointed out, keep the disease in abeyance, and if earnestly pursued prevents it in most cases from shortening life; but the relaxation of vigilance will be followed by rapid and fatal developments. Leprosy in consequence of the opposing influences to the successful operation of the law of segregation maintains its *status* in Hawaii. The biennial report of 1892 shows that there were 1,123 lepers collected at the leper settlement, the previous report giving the number as 1,159.

MEMORANDA.

(1) Dr. Morwitz says:

If 100 Hawaiians (sexes mixed) had continuous contact with leprosy for a period of years, say five to fifteen, at the expiration of that period no less than 82 would have become lepers, the remaining 18 would be clean, and these latter are the class who are illustrations of leprosy being a noncontagious disease. I have come to the conclusion that about 18 per cent of the Hawaiian race resist the contagion.

(2) Dr. Arning studied the bacillus lepræ for a considerable period in the years 1884 and 1885 at Molokai. He says:

In the so-called anæsthetic cases the bacillus is not found in the anæsthetic patches, in the chronic sores of neurotic parts of the skin, tissue, and bone, but, as nerve excisions have proved to me, in the nerves supplying these mutilated parts with vitality.

Dr. Arning failed in his cultivation of the bacillus in an artificial soil, as did Dr. Lutz, and also in the inoculation of the lower animals, but apparently succeeded with a criminal, Kenau by name, whose sentence of death was commuted

to penal servitude in consideration of his consenting to experimental inoculation with the bacillus. Dr. Arning's experiments established the wonderful vitality of the bacillus lepræ, and its extraordinary power of resisting putrefaction, an examination of the dead showing the germs to be in a state of activity after three months of interment. This observation may be of great importance in an inquiry into the etiology of leprosy. As regards the case of Kenau, he was inoculated September 30, 1884, and in March, 1885, microscopic examination revealed the bacillus in large numbers near the spot of inoculation, and again fourteen months afterwards, though there were no evidences of leprosy. Later, and after Dr. Arning's departure, Kenau became a developed leper and subsequently died of the disease. This case promised to be one of great importance as establishing the contagion or inoculability of leprosy, but investigation, made subsequent to Dr. Arning's departure, seems to prove that Kenau came from a leper family and by heredity, if that is admitted as a factor, or like exposure to cause, if we wish to exclude contagion—may have been affected with the disease. No such experiment, however, was necessary to an unprejudiced observer of Hawaiian leprosy to prove the truth of contagion.

DOES THE PRESENCE OF LEPROSY IN THE UNITED STATES, CANADA, AND MEXICO CALL FOR THE SUPERVISION OF THEIR SEVERAL FEDERAL GOVERNMENTS?

By BENJAMIN LEE, A. M., M. D., Ph. D., of Philadelphia, Pa.,

Secretary of the State Board of Health of Pennsylvania

At the meeting of the American Public Health Association, which took place in the city of Brooklyn in the year 1889, I had the honor to present a paper in which attention was called to the constantly increasing opportunities for the introduction of leprosy into the United States from outside, through our seaboard ports, and the consequent expediency of making that disease the subject of maritime quarantine or exclusion. A resolution was then adopted calling the attention of the United States Government to the subject and suggesting that definite action be taken to prevent the further introduction of the disease. The recommendation received immediate attention from the national authorities and a regulation was adopted by the Treasury Department ordering that any person affected with leprosy discovered attempting to enter the United States at any port of entry should be returned to the country whence he or she came. Under this regulation a number of lepers have thus been denied entrance to the country. So easy is concealment of the disease, however, in its earlier stages, so insidious is its approach, and so numerous are the avenues through which it may gain an entrance from the British possessions on the north, from the West Indies on the southeast, and from Mexico and Central America on the south, quite independently of our seacoast quarantines, that we may reasonably look for a very considerable augmentation of the number of persons suffering from this infection already within our borders. I therefore venture to solicit the attention of the section for a few moments to the question of the domestic quarantine or segregation of lepers. In order to obtain data of a somewhat reliable character on which to arrive at a conclusion, circular letters have been addressed to the various State and provincial boards of health and to physicians especially engaged in the study and treatment of skin disease containing certain inquiries. The replies to that addressed to official bodies, taken in connection with the published observations of well-known specialists, indicates that within comparatively recent times, since 1858, for instance, between five and six hundred lepers have had official recognition in

this country and Canada, and that at the present time 117 cases of the disease are known to the authorities. It also appears that there is an entire absence of uniformity in the methods of dealing with these unfortunates, and that in the majority of the States they are entirely ignored. As Mexico had not at the time that I began this investigation taken part in the deliberations of the American Public Health Association, I unfortunately have no original data from that Government. This is the more to be regretted, inasmuch as they would undoubtedly prove of great intrinsic interest, and also as the rapidly increasing intercourse between the two nations makes the question one of practical importance. The disease is well known, however, in the western regions of that country. There are usually about thirty under treatment in hospital in the City of Mexico, separate wards being assigned them, but segregation is not insisted on. This much for cases of which official cognizance has been taken and most of which have been treated and maintained by governments, whether national, State, county, or municipal. There remain to be considered those which have been under the care of private practitioners. Believing that all such cases would have been seen, in consultation at least, by those who had made diseases of the skin a specialty, and feeling also that the opinions of such men were entitled to especial consideration in regard to the mode of propagation of this affection, and to the necessity, if any, for the adoption of measures for its restriction, I addressed the following series of interrogatories to 34 prominent dermatologists, representing all sections of the country from Canada to California:

DEAR DOCTOR: Believing from the nature of your specialty that you must have met with cases of leprosy, and desiring to obtain reliable data as to its occurrence in this country, I make bold to request the favor of a reply to the following interrogatories: 1. How many cases of that disease have you met with in the course of your practice? 2. How many cases have you at present under treatment? 3. What have been the ages, sexes, and nationalities of your cases? 4. Does your experience lead you to think that there are concealed cases in your city? 5. What, in your opinion, would be the best means of caring for lepers in this country: (*a*) The establishment of a national leper colony, (*b*) the establishment of State or city leper houses, or (*c*) the assignment of special wards in general hospitals to lepers? 6. What are, briefly, your views as to the mode of propagation of the disease, and the expediency of isolation of those infected with it? An answer to the above inquiries, which, if you so desire, will be considered confidential, will be sincerely appreciated by

Yours, very truly,

BENJAMIN LEE.

Twenty-one replies have been received, the results of which may be summed up as follows: Number of cases treated, 90; of which 7 are stated to have been in hospital. Number at present under treatment, 3. In some instances the respondents decline to state. This is only what was to have been expected and can excite no surprise. The ages of the patients have ranged from 9 years to 70. Of 76 cases in which the sex was reported 67 were males and 9 females. Of 32 cases in which the nationality was given 10 were natives of the United States, 6 were Chinese, 12 were South American or West Indian, 2 were Swedes, 1 was Irish, and 1 Canadian. Eight of those reporting consider it probablethat there are concealed or unrecognized cases in the large cities in which they themselves reside. Of course the larger the city the greater the opportunity for hiding and therefore the greater the probability of this course being pursued. The case which recently occurred in my own city, in which a leper in the ulcerous stage was discovered employed as cook in a hotel and had been kept carefully out of sight by the proprietor, is fresh in everyone's mind. Nearly all of the cases which the authorities of our large towns have had to take care of have been lurking in secret places, fully aware of the nature of their affliction. As to the best means of caring for lepers—the three suggestions of the circular having been, as will be recalled, the

establishment of a national leper colony, the establishment of State or city leper houses, or the assignment of special wards in general hospitals: fourteen replies were in favor of the assumption of the care of these unfortunates by the National Government in a leper colony or colonies, on the score of humanity to the victim and of benefit to science as well as of protection to the public. The suggestion was made by one that in every large city a ward in a general hospital should be set apart for the observation of suspects before they were removed to the central colony or hospital. Two were of the opinion that the several States or cities should establish leper houses. Ten were convinced that the treatment of lepers in special wards of a general hospital or at their own homes even, under proper environment and police surveillance, would not be attended with risk to the public, but five of these considered that, all things taken into account, the General Government was the proper authority to assume this burden, and that better results would thus be obtained than in any other way. As to the mode of propagation no doubt was expressed by any of the twenty-one as to the communicability of the disease. Nine took strong ground as to its conveyance by inoculation alone, either mediate or immediate, considering its manner of communication almost identical with that of syphilis, while nine others were not inclined so to restrict it, preferring to say that the precise mode of infection was to them unknown. Only two referred to heredity as a possibility. It is quite safe to say that this latter doctrine is now entirely without scientific adherents among those who have enjoyed a large field of observation. Now, I am quite willing to admit that there is overlapping in these reports; that some cases which have been seen in consultation by two physicians have been reported by both; also that many of the cases reported by physicians are included among those reported by boards of health. From this exception, however, we may exclude almost entirely the cases officially reported from New Brunswick, British Columbia, California, Louisiana, Wisconsin, Minnesota, and Iowa. Making all due allowances for duplication, it must be allowed that whether we consider the extent of geographical distribution, the differing nationalities, the various ages, or simply the number of victims of this most horrible of all diseases, the general resultant is such as to render the question worthy the attention of the national legislatures of all the countries represented in this congress.

THE COMMUNICABILITY OF LEPROSY.

By Dr. BEAVEN RAKE,

Medical Superintendent of the Trinidad (British West Indies) Lepers' Asylum, Late Member of the Indian Leprosy Commission.

A brief statement of my views regarding leprosy may be divided under six headings, as follows:

1. *Bacteriological evidence.*—It is now admitted that leprosy is associated with the presence of a specific bacillus. This ought to be found at some period or other in the course of the disease. If this bacillus is not found it is due either to imperfect examination or to the fact that in some old and long established cases of leprosy the bacillus may die and disappear from the tissues. Numerous attempts have been made to cultivate this bacillus by Hansen, Neisser, Bordosi, Uffreduzzi, Giantuico, Campana, Arning, and the members of the Indian Leprosy Commission, but in no instance has success been certain. Uffreduzzi's culture was accepted by Baumgarten, but neither his culture nor that of any of the others produces leprosy when injected into animals. Thus only the first of Koch's four postulates as to the dependence of a disease on a specific microörganism has been fulfilled in the case of leprosy, and though from analogy with other diseases we are

driven to the conclusion that the disease is due to a bacillus we are still without proof of the assumption.

2. *Inoculations of animals.*—Many different kinds of animals have been inoculated with leprous products by Neisser, Damsch, Vossius, Köbuer, Hansen, Campana, Thia, Kansic, Arning, Leloir, Bordoni, Uffreduzzi, and many other observers in various parts of the world, but hitherto without success. Neisser described a local growth in a dog, but there was no general development of leprous tubercles. I have made experimental inoculations of animals in the Trinidad Leper Asylum, extending over about nine years, but the results have been negative. Some of the animals have been under observation upward of four years, one as long as eight years from the date of inoculation to that of death, and no development of leprosy has taken place. I have also fed fowls and pigs with leprous material for periods of one or two years and the results in these animals have been equally negative. Melchen and Ortman have described dissemination of nodules in the viscera of rabbits after inoculations of leprous tubercle. But Wesener and Hüppe believe these nodules to be those of tuberculosis, though Arning and Ruffer accept them as leprous. On the whole we must regard the evidence derived from inoculations of animals as negative, and this seems to support Beriner's view that leprosy is an essentially human disease and can not be transmitted to animals.

3. *Inoculations in the human subject.*—Arning inoculated Kenau, a convict in the Sandwich Islands, with leprosy, and the man developed leprosy three years afterwards. But leprosy is extremely prevalent in these islands, and Kenau may have derived it from other sources. It was also discovered later that three of his relatives were lepers, so that it would seem that in his family there was a peculiar aptitude for taking the disease. If a criminal in a country such as England where leprosy is not endemic could be inoculated with the disease, and if such criminal after inoculation developed leprosy, we should have a scientific proof of the inoculability of leprosy. Profeta, in Italy, inoculated himself and several healthy individuals with leprosy, but none of them developed the disease. A physician in Norway performed a similar experiment on himself and several other healthy people, but here again the evidence was negative. Holst and Iitsch also failed to inoculate healthy individuals. Hansen inoculated anæsthetic lepers with material from tuberculated leprosy, but without success. I have inoculated 40 anæsthetic lepers in the Trinidad Asylum with material from tuberculated lepers, 2 of the 40 have developed tubercles, but this evidence is not of absolute value, for anæsthetic lepers have been described by Leloir as occasionally becoming tuberculated. Thus the evidence obtained from inoculations in the human subject may be regarded as negative with the exception of Arning's case, and this is open to grave doubt.

4. *Vaccination.*—Hardner, in 1887, reported a case in a tropical island where a child became leprous after being vaccinated with lymph from another child who afterwards developed the disease. Danbler, at the Cape of Good Hope, also recorded 2 cases in which he believed that leprosy was conveyed by vaccination. More recently Chew, in Calcutta, has brought forward a number of cases in which he believes that leprosy was invaccinated. But all these cases occurred in districts where leprosy was endemic, and are, therefore, open to the objection brought forward in the case of the convict, Kenau, viz., that the disease may have been derived from other sources. If a child in a country free from leprosy were inoculated with lymph from a country where lèprosy is prevalent and after such vaccination developed leprosy we might consider that the proposition had been scientifically proved. An experiment which somewhat approaches the above hypothetical one has been performed in India, where during a period of some twenty years Surg. Maj. Pringle was in the habit of bringing vaccine lymph down from the hill districts of British Garhwal, a locality in which the percentage of leprosy

is very high, and vaccinating children in the plains between the Ganges and Jumna, where leprosy is far less common. Census returns taken at intervals of ten years in these districts showed not only a decrease of leprosy in British Garhwal, but also in the vaccinated districts in the plains. If vaccine lymph were an efficient mode of conveying leprosy we should have expected an increase of the disease in the plains. Arning and Simpson have described leprosy bacilli in the vaccine lymph of lepers, but examinations of nearly 40 specimens in the Trinidad Asylum and of nearly 100 by the leprosy commission in India were negative. We may therefore conclude that in no case has it been proved that the leprosy has been conveyed by vaccination.

5. *Practical experience.*—By this I mean histories of contagion given to us by patients, or cases reported by others. While in India we examined some 2,000 lepers, and many histories of contagion were given, but on close examination all these broke down with the exception of one case, that of an attendant at the Leper Asylum at Calicut, who contracted the disease after he had been for some years at the asylum. Father Damien's case is often quoted as an example of contagion, but this, like the Calicut case just mentioned, and like all cases reported from leprosy-infested countries, is open to the objection that the disease may have been derived from other outside sources. To eliminate this fallacy of concomitant variations we must look to cases of contagion in countries free from leprosy. Two such cases seem free from doubt. One was reported by Dr. Hawley Benson in Dublin. A man returned from service in India and developed leprosy. His brother, who had never been out of the United Kingdom, slept in the same bed with him, and about two years afterwards this brother also became a leper. The cases were shown at the Dublin Medical Society, and there seems to have been no doubt as to the diagnosis, for doctors were present who had seen leprosy abroad. The second case occurred in Maryland, and was reported by Dr. Atkinson. A woman who had not been out of the country became leprous some years after contact with a leper. In Maryland we know that leprosy is not endemic. Thus we may, perhaps, admit two positive cases against a very large number of negative ones, for it must be remembered that there are hundreds of doctors, nurses, and attendants in constant contact with lepers, but these never develop the disease.

6. *Alleged increase of leprosy.*—It has been said that leprosy has largely increased of late years. Published figures show this statement to be incorrect in most parts of the world where annual leper censuses are taken. In Norway there has been an almost uninterrupted downward curve for the last thirty years, in spite of the fact that in that country segregation has never been absolute. Until 1885 there was no law compelling the isolation of lepers, and even then it only enacted that they should be separated from the rest of the family to the satisfaction of the sanitary inspector. Failing this they were to go to an asylum. Dr. Ransia, of Molde, states that only 14 have come into the asylum since 1885 by reason of the new law. In Iceland, also, there has been an enormous decrease in the last hundred years. There has been no segregation. In India the censuses of 1881 and 1891 showed an absolute decrease of over 4,000 lepers, and this in spite of the fact that in Burmah, Rajpootana, Travancore, and the central province states no leper census was taken in 1881, while in 1891 a full census was taken, showing many thousands suffering from the disease. It is therefore almost certain that the decrease in India is much greater than that shown in the official census return. In India hardly any attempt is made to isolate lepers. In the Northwestern States of North America about 160 Norwegian lepers came over many years ago. Only about 13 lepers now remain. There has been no development of the disease in their descendants nor in any Norwegian or others in contact with them in this country; segregation is not strictly carried out among them. In Trinidad the ratio of lepers to the population has remained almost stationary; there is no

compulsory isolation. In the Sandwich Islands segregation is compulsory, but in spite of this the official returns show that in the last twenty years the number of diseased has almost quadrupled. In Meinel, on the Russian border, there has been a small increase of leprosy in late years; no contact has been traced with lepers. It would thus appear that in Norway, Iceland, India, and the Northwestern States of North America there has been a large absolute decrease of leprosy apart from the segregation; that in Trinidad the ratio of lepers to the general population has remained practically stationary, while in the Sandwich Islands, where compulsory segregation has been enforced for many years, there has been an enormous increase. It seems that in certain districts the disease may increase by reason of certain local factors of which we are ignorant, as, for example, in Meniel.

Conclusion.—We believe that leprosy is due to a specific bacillus, and therefore we must admit the possibility of its communicability. Evidence, however, derived from the sources mentioned above shows that if it is communicable at all it is in such rare instances and with such difficulty that for practical purposes we may disregard the possibility. I would place leprosy and tuberculosis in one class. I believe that the bacilli of both are present in the dust of certain localities and that dwellers in such localities are constantly coming in contact with the bacilli. Only in those who are weakened from various causes do the bacilli find suitable soil for development, and these individuals become the subject of leprosy, or tuberculosis. The accumulated evidence goes to show that leprosy is rather less communicable than tuberculosis, and that if we isolate lepers, we ought *a fortiori* to shut up those suffering from tuberculosis.

SUGGESTIONS FOR A PLAN TO ENABLE THE MASTERS OF MERCHANT VESSELS TO PROPERLY CARE FOR THOSE ATTACKED AT SEA WITH YELLOW FEVER.

By G. FARRAR PATTON, M. D., of New Orleans, La.

It is a fact well established by the experience of quarantine physicians whose duties have brought them into contact with vessels upon which yellow fever has appeared while at sea that of those attacked with the disease a great many die from the obvious want of proper care and treatment. From a careful comparison of statistics it would appear that the mortality from yellow fever on shipboard ranges from 50 to 70 per cent, against a death rate of from 15 to 30 per cent in the great epidemics that have visited our American cities in this century. This is easily explained by taking into consideration the want of experience, and consequent excusable ignorance, of the average shipmaster as regards the management of yellow-fever cases. Unfortunately our science, far reaching as it is, does not as yet enable us to offer to the unacclimated any reliable measure of protection in the face of exposure to this disease. Certain measures have been brought to the notice of the public as tending to guarantee immunity against the special infection of yellow fever; but without reviewing these in detail, it is safe to say that the medical profession and the public alike refuse to put any faith in them. It would seem that the only safeguard against yellow fever is the avoidance of exposure. If non-intercourse with infected places could be maintained, the spread of the dreaded pestilence would cease, but as long as the requirements of commerce call for the sacrifice the hardy seaman will continue to risk his own life and endanger the safety of healthy communities by traffic with the fever-infected ports of the Tropics. We know that by a rigid system of quarantine we can protect ourselves, but we are practically powerless to protect these wanderers of the

sea against the insidious and deadly infection to which the exercise of their calling exposes them. We are bound, however, as members of a great and humane profession, to consider the question of extending to them, when they may be stricken with pestilence upon the lonely seas, such aid and guidance as may be possible. Therefore, while we are assembled in council to devise and perfect schemes for the protection of our homes and families against imported pestilence, shall we not also give some thought to these unfortunates whose fate it is thus to suffer hardship, privation, and disease, far from the reach of medical aid or other human help, save that of rough though kindly shipmates? These considerations have forced themselves upon the attention of the writer during a long experience with quarantine work, dating back to 1877, and an almost daily observation of the habits and needs of seafaring people since that time. It is with the firm conviction that something can be done, and easily done, in the way of enabling the masters of merchant vessels to supply rational and fairly successful treatment to such of their people as may develop yellow fever at sea, that the plan here proposed for indorsement by the Pan-American Medical Congress is presented. It frequently happens that no cases of fever occur among the crew of a vessel until after sailing from an infected port. It would almost seem as if breathing the fresh air of the open sea develops the latent poison in the patient's system. The captain, congratulating himself upon getting away from Havana or Rio de Janeiro without losing any of his men, soon finds himself in command of a floating hospital as case after case of fever develops among his crew; and with no knowledge or experience as to the care and treatment of the sick, he is confronted with the grave responsibility of attending them. Now, while the treatment of yellow fever, as regards the mere giving of medicine, is comparatively simple, there is perhaps no disease in which an early diagnosis, with reference to expectant treatment and the enforcement of absolute rest in a horizontal position, is of greater importance. In fact, it may be said that upon this enforced repose, especially during the fatally delusive "stage of calm," and upon the withholding of unsuitable articles of diet, the patient's life hangs as upon a thread. Among men so little accustomed to illness as sailors these vitally important conditions are difficult to secure. The writer calls to mind an instance in which, the cook of a vessel being ill, the steward, also ill but feeling better, arose on the fourth day of his fever and crawled to the galley to cook dinner, only to faint from weakness and die within twenty-four hours. On the same vessel the first victim, a sturdy seaman, refused to yield to the attack, and stood his watch of four hours at the wheel, from which, when relieved, he had to be carried to the forecastle. The captain of that vessel was by no means a hard master to his men, but he simply did not know what to do. It might easily happen that a panic would spread among the crew of a ship, the timid imagining themselves sick, while others, really ill, but actuated by a stern devotion to duty, would sacrifice their lives by continuing at work. To guard against this, and in view of the known disposition of mates to suspect alleged sick men of malingering, it is important that the master of every merchant vessel should possess a clinical thermometer and be familiar with its use, a requirement so simple that no man capable of navigating a ship need hesitate about complying with it. Since circumstances force the shipmaster, in addition to his other duties, to assume the grave responsibility of superintending the care of his men when attacked with yellow fever at sea, those who have it in their power to supply him with information that will better fit him for the task should come to his aid; and this is what is contemplated in the plan here proposed. This plan, briefly stated, is as follows: Let it be made part of the duty of consuls in yellow-fever ports to furnish the master of every vessel clearing from such ports with a printed memorandum of instructions, to be issued by competent medical authority under Government supervision, and setting forth in

simple language the principal points which it may be deemed necessary to impress upon the shipmaster for his future guidance. Among these points the one demanding the first consideration is perhaps that of placing the vessel in the best possible sanitary condition by thoroughly cleaning and disinfecting, after approved methods, every article of clothing, bedding, etc., on board, fumigating rooms and cabins, washing out and disinfecting bilges, and in every way striving to destroy any germs of disease that may be present. The crew should be officially notified that as they value their lives they must report promptly the first symptoms of illness. In this connection the instructions should describe the method of using the thermometer as being the only reliable guide in discovering at the very outset the existence of fever, thus furnishing an invaluable means of detecting malingerers. In the opinion of the writer an expectant plan of treatment should be pursued in every case, however mild the symptoms. The details of this treatment need not be enumerated here; but over and above all other directions that of forcing the patient, after the disease is established, to remain absolutely at rest in a horizontal position should be rigidly insisted upon. With hardy men like sailors it often requires the exercise of positive authority to compel obedience in this particular, especially where attention to the wants of nature is concerned. Due stress must be laid upon the delusive feeling of comfort experienced during the so-called "state of calm," for it is here that the greatest vigilance is required to prevent the patient from exerting himself in some way that will prove fatal. Seafaring people are hearty eaters, and it is often difficult to prevent the patient on shipboard from taking unsuitable food under the mistaken impression that he needs something substantial to sustain his strength. This point deserves especial emphasis, and no schedule of instructions would be complete that did not give explicit directions as to the proper nourishment of yellow-fever patients, as well as the rules for the administration of stimulants. The consul charged with delivering the instructions should require every captain not already provided with a thermometer and the several articles of diet enumerated in the printed list to supply the deficiency before sailing. To secure faithful nursing, which in yellow fever is recognized as being the most important requirement, two intelligent and trusty men should be detailed as attendants upon the sick, and it should be impressed upon them that, in the opinion of a majority of experts, the patient himself does not diffuse the poison which causes the disease, but that it may be retained by his clothing. Therefore, if all the clothing and bedding has been previously disinfected and the rooms fumigated, the attendants need feel no special apprehension beyond that of the possibility of their already having the germs of the disease in their own systems. If these various points be forced upon the attention of an intelligent shipmaster just prior to sailing, his crew will certainly have a far better chance of being successfully treated should yellow fever appear among them than is at present the case. From a long and intimate association with seafaring people the writer is firmly convinced that the majority of shipmasters will not only receive such instructions gladly, but, as a rule, they can be depended upon for the faithful execution of every detail. In 1880, while on duty at the quarantine station below New Orleans, the author of this paper published one of similar purport in two of the great English newspapers in the hope that the leading maritime nation of the world might be induced to take the initiative in such a measure. However, beyond some gratifying editorial comments, one of which appeared in the London Lancet, no special notice seems to have been taken of the matter. Now that the opportunity presents itself to put forth another appeal, under the auspices of a great international congress such as this, it is earnestly hoped that a more effectual impression may be produced.

THE QUARANTINE LAW OF JAMAICA.

By JAMES CECIL PHILLIPPO, M. D., of Kingston, Jamaica, British West Indies

Whereas it is desirable to consolidate and amend the laws relating to quarantine:

Be it enacted by the governor and legislative council of Jamaica, as follows:

1. The quarantine law, 1869 (law 37 of 1869), and the laws amending the same (law 32 of 1872 and law 10 of 1892), shall be, and the same are hereby, repealed: *Provided*, That notwithstanding such repeal any penalties incurred under the said laws, or either of them, prior to such repeal may be recovered and enforced as if this law had not been passed.

2. In this law the term "infected place" means any port or place or country or definite portion of a country, as hereinafter provided, where yellow fever, the plague, cholera, or any epidemic disease of a contagious or infectious character, in fact prevails, or which the governor in privy council may declare to be an infected port or place. An infectious or contagious disease shall be deemed to "prevail" in a place, within the meaning of this law, when such disease has been communicated to one person, or more than one person, through the medium of a person sick of such disease arriving in such place, or of goods, personal effects, or other things, introduced into such place; but it shall not be said to prevail in a place merely because a single case, or a small number of cases of disease as aforesaid, has been imported into such place, where the disease has not been communicated to others. The word "vessel" means any ship, vessel, or boat; and the word "master" means the master, officer, or other person for the time being in charge or command of such vessel, and the term "visiting officer" means a person appointed at any port of the island by the governor for the purpose of carrying out the provisions of this law. "Lazaretto" shall mean any vessel moored in any quarantine ground, or any place on shore contiguous to a quarantine ground, appointed by the governor in privy council under the provisions of this law, within which any person arriving on any vessel that shall be put into quarantine may stay during the continuance of such vessel in quarantine, or if such vessel leaves the island instead of going into and remaining in quarantine, during such period as such vessel would have had to continue in quarantine if she had not so left the island.

3. The governor is hereby authorized to appoint not less than three, or more than five, persons to be a board, to be called "the quarantine board," to hold their offices during pleasure, and from time to time to fill up the vacancies in such board; and also, in case any member of the board appointed as aforesaid shall be temporarily absent from the island, or be ill or otherwise unable to act, to appoint some person to act as a member of the board during the absence or inability to act of such member. Such board, of whom two shall be a quorum, shall have full power and authority to superintend and enforce the carrying out of the laws, rules, and regulations, for the time being in force relating to quarantine: *Provided*, That the board heretofore appointed under the provisions of law 37 of 1869 shall be deemed to be the board appointed under the provisions of this law, without further or other appointment.

4. The governor is hereby authorized from time to time to appoint such officers as may appear to him to be necessary to carry out, under the direction of the said board, this law, and the rules and regulations made thereunder, and all such officers shall hold their offices during pleasure.

5. It shall be lawful for the governor in privy council from time to time to make such rules and regulations as to him shall seem fit for the more effectual carrying out the provisions of this law and to secure the due performance of

quarantine; and for the government of all vessels, persons, animals, and cargo put into quarantine under the provisions of this law; and for prescribing, in each port of the island, a point beyond which no vessel shall come, and from which no person shall land, or cargo or luggage shall be discharged, until such vessel shall have been visited by the visiting officer; and for prescribing, subject to any exceptions mentioned in such rules, a distance from vessels in quarantine within which it shall be unlawful for any person to come, and within which it shall be unlawful to send or permit to be sent any person or thing; and also, from time to time, to make rules and regulations respecting the disinfection of vessels and their contents liable, under any of the provisions of this law, to be disinfected before such vessels shall be allowed to discharge cargo. Such rules and regulations may extend not only to the mode of disinfection to be adopted and the extent of such disinfection and the sum of money to be paid by the master of the vessel as the cost of the same, but they may also prescribe any port or ports to which all vessels arriving in this island, having goods, merchandise, animals, passengers, or passengers' luggage on board, liable as aforesaid to be disinfected, shall repair for the purpose of being disinfected before landing any of such goods, merchandise, animals, or luggage. The governor in privy council may, from time to time, alter or amend any such rules and regulations; such rules and regulations, and altered or amended rules and regulations, shall be published in the Jamaica Gazette, and, after such publication, shall have the same force and effect as if the same had been herein particularly specified.

6. Whenever the governor in privy council shall have reason to believe that any disease of a contagious or infectious character prevails at any port or place, or in any country, or definite portion of a country, or that it is probable that any such disease may be brought into the island from any port or place, or country or portion of a country as aforesaid, it shall be lawful for him to declare, by notification in the Jamaica Gazette, that such port, place, or country is an infected place: *Provided*, That when the governor in privy council shall, under the provisions of this law, declare any port or place to be infected, he shall specify the disease or diseases with which such port or place is infected. It shall be lawful for the governor in privy council, by a notification as aforesaid, to withdraw, and to declare to be no longer in force, any such public notification as aforesaid.

7. Every vessel arriving at any of the ports of this island shall, immediately on arrival, and before having any communication with the shore, or passing the point prescribed under rules or regulations made in that behalf, be visited by the visiting officer of the port to which such vessel shall come, who is hereby authorized and required, at a convenient distance from such vessel, to put the following questions, or such of them as may be necessary, and any other questions which he may consider desirable: (1) What is the name of the vessel, and of the master? (2) To what port or place does she belong? (3) From whence do you come? (4) To what port or place are you bound? (5) At what ports or places have you touched in the course of the voyage? (6) What vessels have you had any intercourse or communication with during your voyage, and from whence did they come? (7) Have you any and what bill of health? Produce it. (8) Did you carry any bill of health with you to the port or place where you took in the cargo or passengers you now have on board? From what place? Were the said bills of health clean, unclean, or suspected? (9) Did any contagious or infectious disease prevail in any degree at the port or place from which you sailed, or at any of the ports or places at which you touched? If yes, say what disease prevailed, and at which port or place. (10) What number of officers, crew, passengers, or other persons have you on board? (11) Were any of these taken on board at any port or place during the voyage to this island; if yes, who were so taken on board, and at what port or place, and on what day or days? (12) Are any persons on

board your ship suffering under any contagious or infectious disease; or have any persons died or been ill of any disease of that nature in your passage to this island; and, if any, what number? (13) If any have died or been ill of any such disease, have their bedding and clothes been destroyed? (14) In the course of your voyage have any persons on board suffered from sickness of any kind? What was the nature of the sickness and when did it prevail? How many persons were affected by it? (15) How had the persons attacked been employed before they came on board; had they been employed in loading or unloading the vessel? (16) Did the persons who were ill fall sick nearly about the same time, or within a few days of each other; or did the disorder spread successively from one to another and increase considerably? (17) What is the number of persons now ill on board your vessel? Are the convalescents able to be on deck? If so, parade them on the gangway. (18) Have there been any deaths on board during the voyage; if yes, what were the causes of the deaths, and when did such deaths take place? (19) Have you any person on board who has left (name of infected port or place) within fourteen days? (20) Where did you take in the cargo now on board, and when? If at more than one place, state the places. (21) Was any cargo, or were any letters, parcels, or articles of any kind put on board at (name of infected port or place)? If yes, state what was put on board, and when, and whether any special precaution was taken with respect to such thing.

8. The said visiting officer may, if he thinks it necessary, go on board any such vessel and examine the master, officers, crew, and passengers thereof respectively, as to their state of health then and during the voyage, and may examine the journal or log and ship's papers of such vessel, and put any of the questions set forth in the preceding section, or any other question which he shall think desirable.

9. Any master or other person who shall conceal from any visiting officer the true state of the health of the crew or other persons on board such vessel, or who shall give an untrue answer to any inquiry made by such visiting officer under the authority of this law, shall be liable to a penalty not less than £5 and not exceeding £100.

10. No master or other person belonging to or on board of such vessel, and no pilot or pilot's assistant who shall have proceeded on board such vessel, shall quit the same, for the purpose of landing or communicating with the shore, before such vessel shall have been visited by the visiting officer, unless permission to do so be granted in writing by the visiting officer.

11. No person, the pilot or his assistant excepted, shall proceed on board such vessel before she shall have been visited by the visiting officer, unless permission to do so be granted to him in writing by the visiting officer.

12. Any person offending against the provisions of either of the two last preceding sections shall be liable to a penalty of not less than £5 and not exceeding £50.

13. The quarantine board shall, with the approval of the governor, appoint suitable places for quarantine grounds, and shall have power, with the like approval, from time to time to change such places.

14. If any vessel shall have arrived from or touched at any infected place, or shall have on board any person who has come from such place, or on board which any person may have died during the passage to this island, or may be ill of any contagious or infectious disease, or shall arrive without a clean bill of health from her port of departure, or if the visiting officer shall have good grounds to suspect that such vessel has arrived from or touched at any such place as aforesaid, or has on board any such person as aforesaid, or that any person has died or is ill as aforesaid, the said visiting officer is required to put the said vessel into quarantine.

15. Notwithstanding that any vessel arriving at any port of the island shall not be liable, under any of the foregoing provisions of this law, to be put into quarantine, it shall be lawful for the visiting officer at the port of arrival, in case any

such vessel shall have on board any goods or merchandise that the visiting officer shall have reason to believe are in direct transit from an infected place, so as to make such ship and her cargo a possible source of infection, in his discretion to put such vessel into quarantine for the purpose of there undergoing a process of disinfection: *Provided*, That it shall be the duty of any visiting officer exercising the powers vested in him by this section to at once report the cases to the quarantine board, who may in their discretion support or overrule his decision; save as aforesaid, such discretion shall be absolute, and shall not be subject to be questioned in any court of law: *Provided*, That when any vessel arriving at any port of this island, not being liable under any other provisions of this law to be put into quarantine, shall be put into quarantine under the provisions of this section for the purpose of her being disinfected, such order shall not prevent the landing of any passengers arriving by such vessel, together with such of their luggage as has not been in the hold of such vessel, provided that such passengers leave such vessel with such of their luggage as aforesaid within twelve hours after her arrival, and before such vessel has anchored in the quarantine ground. After the expiration, however, of the above period, or the anchoring of such vessel as aforesaid, all the provisions of this law applicable to vessels put into quarantine shall apply to such vessel, and every person and thing on board her, until the disinfection of such vessel and goods and cargo shall have been completed. Goods or merchandise shall be deemed to be in "direct transit" from an infected place when such place shall have been the place from which their transmission to this island commenced, notwithstanding the fact that in the course of such transmission they may have passed through places not infected, or that the port or place at which they have been put on board the ship bringing them to this island shall not be infected.

16. When the visiting officer shall have allowed any vessel arriving at the port of which he is visiting officer to communicate with the shore without being put into quarantine, and within fourteen days of the arrival of such vessel at such port any person on board such vessel shall fall sick of any contagious or infectious disease, or any fact or circumstance is brought to the knowledge of the visiting officer which, had the same been brought to his knowledge on the arrival of the vessel, would have led him to put such vessel into quarantine, it shall be lawful for such officer, and it shall be his duty, to put such vessel into quarantine. Thereupon the master, officers, and crew of such vessel shall accompany the same to the quarantine ground: *Provided*, That if, before such vessel shall have been put into quarantine as aforesaid, the master, officers, or crew, or any of them, shall have landed and shall be ill on shore, and his medical attendant shall certify that it would be dangerous to his life to send him back to the said vessel, it shall be lawful for the visiting officer to excuse such person from accompanying the said vessel: *Provided also*, That it shall be the duty of the said visiting officer to report to the local board of health of the port any action taken by him under this or the preceding section.

17. Subject to any provisions of this law to the contrary, when any vessel has been put into quarantine by the visiting officer of any port under the provisions of this law, the following rules shall apply, that is to say: (1) Such vessel shall, between sunrise and sunset, hoist a yellow flag on the top of the mainmast, and keep the same there displayed, and shall, during the night, keep displayed such light as may be prescribed by rules made under this law. (2) Subject to the proviso hereinafter contained, she shall, with all persons, animals, goods, merchandise, and other things on board her at the time of her being put into quarantine, proceed to, and anchor at and remain in, the quarantine ground appointed for such port, until duly released from quarantine under the provisions of this law. (3) Until such release as aforesaid, no person on board of or belonging to

such vessel, or any part of the cargo, stores or lading of the same, or any article or thing belonging to the passengers, master, officers, or crew thereof shall be permitted to leave, or be removed or taken from such vessel, either to go or be put on shore (except at a lazaretto as hereinafter provided), or on board of any other vessel in any port of this island, unless by the direction of the governor in privy council, or of the quarantine board, or of some person duly authorized by him or it, and every such vessel, and all goods, persons, and merchandise thereon, and all vessels and persons having communication with the same, shall be subject to such rules and regulations as may be made by the Governor in privy council. (4) Until such release as aforesaid, no person except the visiting officer, or such other person as may be authorized by the quarantine board, shall go on board such vessel; and no article or thing shall be taken or received on board such vessel, except by the direction of the quarantine board, or of the said visiting officer. (5) Notwithstanding that any vessel, with all persons on board her, shall be entitled to be released from quarantine, no passenger on board such vessel shall be entitled to land in this island until he shall have given to the visiting officer an account of his intended movements in the island, so as, in the opinion of the visiting officer, to enable the several district medical officers of the island and the police to report to the governor if any infectious or contagious disease has shown itself among any of them: *Provided*, That nothing herein contained shall make it unlawful for any vessel, ordered into quarantine under the provisions of this law, to put to sea and again enter the same or any other port of the island, instead of going into quarantine: *Provided*, That any such vessel proceeding to sea as aforesaid shall, while at sea, be deemed to be in quarantine to all intents and purposes, and subject to all the rules applicable to a vessel in quarantine until, on again entering the same or entering any other port of the island, she shall be released from quarantine by the visiting officer of such port.

18. No vessel arriving at any harbor of the island, having on board any ballast composed wholly or in part of earth, sand, or mud, as defined by section 2 of law 36 of 1873, shall be allowed, so long as she has any such ballast on board, and for such period as may in the judgment of the visiting officer be necessary, after discharge of the same, for the purification of the vessel, and retaining her under observation, to enter such harbor; but the visiting officer shall, so long as such vessel has any such ballast on board and for such period as aforesaid, treat such vessel in all respects as he would treat her if she had on board a person ill of some contagious or infectious disease: *Provided*, That in any harbor where the place set apart for the deposit of ballast, under the provisions of section 26 of law 36 of 1873, is within the limits of such harbor, if such place is certified by the quarantine board to be a place where such ballast as aforesaid may be thrown without prejudice to the public health, it shall be lawful for the said visiting officer, under such conditions as he shall see fit, to allow such vessel to proceed to the place aforesaid, although such place may be within the limits of the harbor: *Provided*, That, while proceeding to such place, and while lying there, such vessel shall be deemed to be in quarantine to all intents and purposes, save as to the obligation to anchor at the quarantine ground; after the discharge of such ballast as aforesaid, such vessel shall return to the quarantine ground, and there undergo such purification and be under observation for such period as the visiting officer may consider necessary.

19. All vessels put into quarantine shall, together with all goods, merchandise, animals, and passengers, and passengers' luggage thereon, be disinfected before being released from quarantine.

20. It shall be lawful for the governor in privy council from time to time, by order published in the Jamaica Gazette, absolutely to prohibit the importation from an infected place of such articles or things (to be named in such order) as

he governor in privy council may consider to be specially calculated to carry nfection, when the same are the produce of an infected place, or have been, in the course of their direct transit to this island within the meaning of this law from the place of production, on board any vessel having on board a person ill of any contagious or infectious disease. Such article or thing shall thereupon be deemed to be a prohibited article or thing within the meaning of section 37 of the customs consolidation law, 1887, and all the provisions of the said law shall apply to the same accordingly.

21. Subject to any special rules and regulations of the governor in privy council, and to the proviso hereinafter contained, the following rules as to the duration of quarantine shall be observed: (1) All vessels on board of which any person shall be sick, or shall have been sick, of any contagious or infectious disease, or shall have died of such disease within fourteen days before her arrival at this island, shall remain in quarantine until the expiration of fourteen days from the day when such sickness shall cease, or shall have ceased, or from the day when such death occurred. (2) All vessels that shall have sailed from or touched at any infected place, or shall have any person on board who shall have come from any such place, shall remain in quarantine for such time, not exceeding fourteen days, as shall be directed by the quarantine board on a due investigation of all the circumstances of the case. (3) If, during the continuance of a vessel in quarantine, any person on board such vessel falls sick of any contagious or infectious disease, such vessel shall be liable to remain in quarantine for a further period of fourteen days from the day when such sickness shall cease: *Provided*, That no vessel shall, under the provisions of this law, be liable to be put into quarantine by reason only of her coming from an infected place, or of her having on board any person who has come from an infected place, unless such vessel or person shall have been in such place within the times herein limited; that is to say: (*a*) In case such infected place is infected with cholera, six days; (*b*) with yellow fever, ten days, or (*c*) with smallpox, fourteen days previously to her arrival in this island. In case any place shall be or be declared to be infected by reason of the prevalence therein of some infectious or contagious disease other than those above named, it shall be lawful for the governor in privy council to fix the period before arrival in this island which must have elapsed to entitle any ship to the benefit of this proviso.

22. Any master of a vessel ordered into quarantine who shall not, forthwith after receiving such order, cause such vessel to proceed to the quarantine ground, shall be liable to a penalty not less than £100 and not exceeding £400; and it shall be lawful for the visiting officer, or any person called to his assistance, to enforce the removal of any such vessel to the quarantine ground, and to use all necessary means for that purpose.

23. The master of any vessel put into quarantine who shall omit during the day to hoist and keep flying a yellow flag as required by this law, or, during the night, to hoist and keep alight a signal lantern, shall be liable to a penalty not less than £5 and not exceeding £50: *Provided*, That any such flag or signal lantern shall, on demand, be furnished by the quarantine board.

24. Any person offending against the provisions of subsections 3 or 4 of section 7 of this law shall be liable to a penalty not less than £5 and not exceeding £50.

25. If, during the time that any vessel is in quarantine, the master thereof shall, without the permission of the quarantine board or of the visiting officer, quit, or knowingly suffer any passenger, seaman, or other person on board to quit, such vessel, or any goods, articles, or things whatsoever, to be taken from such vessel, he shall be liable to a penalty not less than £10 and not exceeding £100.

26. Any person who, during the continuance of quarantine, leaves the vessel without proper permission in that behalf, may, in addition to the penalty herein-

before mentioned, be apprehended by any constable or other person, and compelled to return to the said vessel, or be taken before a justice, who may order that such person be returned to the said vessel, or be confined in some lazaretto or other suitable place of confinement, for such period, not less than two days nor exceeding fourteen, as he may think fit.

27. Any person who shall go on board a vessel in the performance of quarantine without permission as aforesaid may be compelled to remain on board the said vessel, and be subject to the rules and regulations thereof, during the continuance of the quarantine, or until such time as to the quarantine board shall seem fit.

28. The governor in privy council is hereby authorized, whenever it shall be thought necessary, to provide, at the public expense, one or more vessel or vessels moored within any quarantine ground, or any buildings on shore contiguous to any quarantine ground, as a lazaretto for the purposes of this law, and to cause the same to be fitted up as a lazaretto for such use and purposes as the quarantine board shall, with the approval of the governor, from time to time order and direct.

29. The governor in privy council is authorized from time to time to frame such rules and regulations as may be deemed expedient for the government and direction of any such lazaretto, and of such persons as may belong thereto or be placed therein, and to alter or amend such rules. And it shall be lawful for the governor in and by such rules to require that, before any person shall be allowed to enter any such lazaretto, such sum as shall be fixed by such rules for the maintenance of each person while in such lazaretto shall be prepaid, or secured to the satisfaction of the visiting officer.

30. Any person, except the visiting officer, who enters or leaves any lazaretto without permission from the quarantine board, or from the said visiting officer, may be dealt with in the manner hereinbefore provided in the case of a person without permission going on board or leaving the vessel when put into quarantine, and shall be liable to the like penalties.

31. Any officer or person appointed to enforce the performance of quarantine who shall desert from duty, or shall infringe, or knowingly suffer or permit any person to infringe, the provisions of this law, or of any rules and regulations in force concerning quarantine, shall be liable to a penalty of not less than £5 and not exceeding £50, and shall be subject to immediate dismissal.

32. Any person who shall knowingly conceal, or clandestinely convey, any letters, goods, wares, or merchandise from any vessel liable to or in the performance of quarantine, or from any vessel, house, or other place where any persons or goods shall be subjected to quarantine, shall be liable to a penalty of not less than £10 and not exceeding £50.

33. As soon as any quarantine shall have been fully performed by any vessel or person, the visiting officer or other person appointed by the governor in that behalf shall grant a certificate to that effect; whereupon every such vessel, or person, and all cargo and goods on board such vessel, shall be liberated from all detention on the ground of quarantine.

34. It shall be lawful for the governor in privy council to enforce any rule or regulation to be made in pursuance of this law by a fine or penalty not exceeding, in any one case, the sum of £10.

35. All penalties incurred under this law, or the rules and regulations to be made in pursuance thereof, may be recovered before any two justices, who, in default of payment, are hereby authorized to commit the offender to the nearest jail for any period not exceeding six months: *Provided always*, That upon payment by the offender of the penalties and costs, after commitment, his imprisonment shall cease.

36. All penalties which shall be recovered and paid under this law, or the rules and regulations aforesaid, shall be paid to Her Majesty, her heirs and successors, for the public use of this island.

37. Any visiting officer or other officer appointed to carry out the provisions of the quarantine law, and any person who shall have preferred any charge against any person of an offense under this law, shall, if such charge be dismissed, be deemed to be a "party aggrieved" by such judgment of dismissal within the meaning of the appeal regulation act, 1857.

38. For the protection of persons acting in the execution of this law, all actions and prosecutions against any person for anything done in pursuance of this law shall be commenced within three calendar months after the act committed, and not otherwise; and notice in writing of such action, and the cause thereof, shall be given to the defendant one calendar month at least before the commencement of the action, and in any such action the defendant may plead the general issue, and give this law and the special matter in evidence at any trial to be had thereupon; and no plaintiff shall recover in any such action, if sufficient amends shall have been tendered or paid into court by or on behalf of the defendant; and if a verdict shall pass for the defendant, or the plaintiff shall become nonsuit, or discontinue any such action after issue joined, or if, upon demurrer or otherwise, judgment shall be given against the plaintiff, the defendant shall recover his full costs as between attorney and client, and shall have the like remedy for the same as any defendant hath by law in other cases; and although a verdict shall be given for the plaintiff in any such action, such plaintiff shall not have costs against the defendant unless the judge before whom the trial shall be shall certify his approbation of the action and verdict obtained thereon.

39. It shall be lawful for the governor to authorize, by warrant upon the treasurer, payment of any expenses incidental to the execution of this law.

40. Nothing in this law contained shall extend, or be construed to extend, to prevent the delivery, by the officers in charge of Her Majesty's mails, of any mails that may from time to time be on board of any steam vessel, under such rules and regulations for the prevention of the introduction of any of the beforementioned diseases as may from time to time be made by the governor in privy council, who is hereby empowered to make such rules and regulations with regard to the landing and receipt of the said mails, and in regard to the coaling of the said steamers in any port within this island.

41. It shall be lawful for the governor in privy council from time to time to suspend the operation of this law, or any part thereof, and for such period of time as may be thought expedient, and again to revive the same, or any part thereof.

42. All rules and regulations existing and in force in relation to quarantine at the time of the passing of this law, so far as such rules and regulations are not inconsistent with, and might have been made under, the provisions of this law, shall be and remain in force until other rules and regulations shall be made under this law.

THE DISTRIBUTION OF DISEASE BY ISTHMIAN PRACTICES; OR THE DIRECT RESPONSIBILITY OF COLOMBIA, SOUTH AMERICA, ON ACCOUNT OF THE INTERMENT AND DISINTERMENT OF THE DEAD ON THE ISTHMUS OF PANAMA.

By WOLFRED NELSON, M. D., of New York City.

The title of my paper may excite some surprise, but that which follows, I believe, will justify it; and if this contribution shall lead to an investigation and verification of my statements my efforts will not have been made in vain. When I reached Panama, in May, 1880, during an epidemic of yellow fever, the burial of the masses in the Campo Santo and the regular disinterment of them were practices sanctioned by forty years of uncriticised freedom. Apart from the old-time bovedas (of which more anon), the small Campo Santo, or "God's acre," was on the left of the road leading to the Boca del Rio Grande. For fully forty years previous to the time referred to the masses, after death, were buried in that small enclosure. It was less than an English acre in extent; nearer three-quarters of an acre, I should say. Year after year the same ground was dug over and over again to make way for new tenants. Coffins were seldom used. A coffin at Panama is deemed a positive luxury by the masses. In the few instances where coffins were used they were turned out when the ground they occupied was needed, together with their contents, under a fierce tropical sun. The practice then was, and is now, to rent a coffin, called by the French, in happy phrase, *cercueil d'occasion*. The coffin was carried by friends to the Campo Santo. There the body was taken out and lowered into the grave, wrapped in its winding sheet. The coffin, having earned *dos soles*, or $2, was taken back to the undertaker's in the city of Panama, to spread new disease. The soil of that cemetery had my close attention. It was largely argillaceous, or clayey, mixed with sand, a soil the absorbent power of which is of the lowest. To repeat, for fully forty years a highly remunerative business had been done in burying and disinterring bodies there. Having, with the late Mr. John Stiven, of Panama, faced an epidemic of smallpox and yellow fever, I joined him in denouncing the practice in the Star and Herald, of Panama, in English, and in *La Estrella de Panama*, in Spanish, each of us making a plain statement of the facts over our respective signatures. The articles created a profound sensation. The president of what was then the sovereign State of Panama, it has since been deprived of its sovereignty, and to-day is a federal department ruled from the national capital, or *Santa Fé de Bogota*, was Don Damaso Cervera. He promised the board of health of the State, from which I had resigned, in common with Drs. Iturraldi and Nouel, that the practice of disinterring the dead should stop. In the meantime the very large mortality incident to the work on the Panama Canal, directed by the leading *undertaker* of the century, Count Ferdinand de Lesseps, had made necessary the opening of a new cemetery. This new burial place was within 150 feet of a narrow glen or valley in which were two old-time Spanish wells, dug down for 50 or 60 feet below the level of the five cemeteries there, called, respectively, the "Campo Santo," the "New Cemetery," the "Jewish Cemetery," the "Foreign Cemetery," and the "Chinese Cemetery," situated beyond the new one. Incredible as it may seem, water, literally cemetery drainage, was taken from these two wells and sold by aquadores in the city of Panama for drinking purposes. In our published articles we denounced the wells. The president promised that the selling of the water taken from them should cease. For a time the disinterment of the dead was discontinued, since there was ample room in the new cemetery, but the water from the wells was sold as formerly. The old-time cemetery, after four decades of fertilization by thousands of bodies, became green with grass, and forgotten, as far as the lay mind was concerned. Soon the new ceme-

tery, in spite of its great size, was wholly filled; row after row of graves, each marked by a plain cross bearing a number and a date. The concessionaire, Don Nicanor Obarrio then and now—he owned the wells and had a money-making undertaking establishment near by them—began burying bodies in a large field just back of a line of new bovedas in the new cemetery, these bovedas being a line of vaults or niches running parallel with the main road, or that already referred to as leading to the Boca. The construction of the bovedas I shall refer to later. Midway in the section of bovedas was an opening in the masonry and a gateway leading to the field in question. Therein the energetic and enterprising Señor Don Nicanor Obarrio placed the new cemetery's overflow. But here pray pardon a glance backward. Adjoining the Campo Santo was a vast quadrangle in stone, the old-time bovedas. It had an entrance on the main road, and one directly opposite leading into a field lying toward the Bay of Panama. Within that stone enclosure were four sides of a square, all in masonry, or three tiers of openings, each large enough to admit the coffin of an adult. When the coffin had been placed within, the aperture externally was closed by brickwork and cement, or by a slab of marble, on which was the usual inscription, "*To Fulano de Tal*" or "*To Doña Anita*," as the case might be. Rent for these burial niches had to be paid in advance for eighteen months. At the end of that time if new rent was not forthcoming a Colombian eviction was in order. The coffin and its contents were taken out of the gate leading to the field, and there dumped. Occasionally, when the pile became too large, it was burned. The bovedas system is used by the best classes of the Isthmus. In the Foreign Cemetery, the fifth in that locality, bodies are buried in the earth, there to stay. In some instances, in the case of bodies laid away in the niches of the bovedas, the rent required was renewed, and a very few of the dead in that quadrangle were left in peace. But eviction was the rule. The majority, like their poorer brethren over the way, were transients. So much for the bovedas system as it is operated at Panama to this present day and hour. To return briefly to the new cemetery: It was opened in July, 1884. The ground was consecrated with impressive formalities. A military guard and a band of the Zapadores were present, as were also prominent Government officials and members of the consular corps. It was a half holiday in the city. The affair took on an air of festivity that I had hitherto failed to observe in cemeteries; the joyousness of a graveyard had failed to impress me in the past. Between July, 1884, and the 12th of April, 1886, that new cemetery had received for burial in the earth 3,884 bodies, quite apart from the hundreds buried in the bovedas or niches. Not only had the cemetery been filled, but work was going on in the field in the rear. As a faithful historian, I may say, *inter alia*, that the opening of the annex was unattended by any ceremonial. Panama was making a new record for herself as a pestiiential center.

Mr. President and members of this section, this is not the "tale of a traveler." What I have described continues to this very day and hour. I have official authority for my statement. I have made reference to the crosses over the graves, the first of which was numbered "1," with the date and "1884." The crosses bore no names. A ledger gave the name of tenant No. 1. Pray note the paper cross that I hold in my hand. Its center bears the number "2,558;" above is the date "1886;" below, the date "1887;" to the left is the date "1889," and to the right, the date "1891." What may that mean? Simply that the number of the grave is 2,558, a permanent distinction; in addition, that said grave had four successive tenants from 1886 to 1891. In other words, that the new and large cemetery was dug over four times in five years. In conclusion, I can but add in the words of a distinguished American, a statesman admired at home and respected abroad, that the state of things in Panama "is a condition and not a theory." It remains now for this body of Pan-American sanitarians and scientists to say what the world is going to do about it.

RESPONSIBILITY IN SPREADING DISEASES AND DEATH.

By Dr. WOLFRED NELSON, of New York City.

An individual is amenable to the laws of the country to which he owes allegiance. When he violates the law of a country other than that of his birth or adoption the laws of that country deal with him. Common sense is common law, and common sense, we are told, is genius in working attire. Nations are mere collections of individuals; they have a responsibility to neighboring nations and to the great family of nations. When a nation is a peace disturber or a law-breaker, international law is called into play to correct mischievous tendencies and prevent undue aggressiveness. Under Anglo-American auspices arbitration offers a remedy equal to all emergencies; a peaceful and friendly way of adjusting all differences, be they what they may. As health laws take or should take precedence, let us as sanitarians try and apply some of the foregoing reasoning to the important themes to be here discussed.

The Isthmus of Panama has been rightly called the "gate to the Pacific." It is a narrow strip of land, a trifle under 40 miles in width, and by rail $47\frac{1}{10}$ miles. It unites Central and South America, its location being at the extreme northern end of South America. That strip connects two mighty oceans, and the Panama Railroad is the link that binds Colon on the Atlantic to Panama on the Pacific. For rough purposes of geographical comparison, place before your mental vision an hourglass in a horizontal position. Let the bulb to the right represent South America, the constriction or neck in the middle the Isthmus of Panama, and the bulb to the left Central America. So much for a crude idea of the three Americas from a geographical standpoint, two of them being vast continents whose littorals are washed by two oceans. Steamer lines converge at Panama and Colon, landing and receiving passengers and cargo. Those making Colon hail from ports in France, Spain, England, Germany, the West Indies, and the United States. Several of the lines named have a coast service for Central and South America. Their cargoes and passengers cross the Isthmus of Panama, there to take any of the lines making the Gulf and the Bay of Panama. They run south from Panama for South American ports; north from Panama for Central American, Mexican, and Californian ports. At San Francisco they connect with transpacific steamers. All of these return to Panama with passengers and cargo for Atlantic and transatlantic ports. The Isthmus of Panama is one of the world's highways, a veritable gate to two oceans.

The water-borne diseases in the Tropics, with which a number of us are most familiar, are yellow fever and smallpox. Many close students of yellow fever deem it a disease of seaports, pure and simple. Of course where introduced during hot weather, under favorable conditions, epidemics result. The sunny South is indebted for its epidemics to the West Indies and Spanish main. I make this statement boldly. Some of us who have studied and traced epidemics both of smallpox and yellow fever within the Tropics will recall ships as their carriers. So much for yellow fever and smallpox. Cholera is the third of the water-borne diseases. The last epidemic was traced to a vessel from Ireland which landed her passengers at New York City. From New York the disease was carried to Panama. At the time the late President Grant was a captain in the United States Army and on the Isthmus with troops en route to California. Steamers from Panama for California left the disease in every port of Central America and Mexico at which they called, and from the coast it extended inland and upland, making fearful havoc. In view of my statements in a paper on the "Burial and Unburial of the Dead on the Isthmus of Panama," and the consequent liberation of millions of germs of yellow fever and smallpox, one must recognize the pernicious results

of such practices and Colombia's responsibility in spreading disease. She is a disease producing and distributing Republic. I beg to emphasize my views as a former practitioner at Panama by quoting Dr. Quijano Wallis. He was vice-president of the Panama board of health and a Colombian. In an official communication he said, in reply to an inquiry made by the board of health of the State of Louisiana:

Comuníqueles que el estado sanitario actual en los puertos de Panama y Colon es por lo general bueno, pues no existe al presente epidemia reinante ninguna, siendo como es conocido que la viruela, la fiebre amarilla y las fiebres palustres, en sus infinitas variedades y formas, nunca faltan en estas regiones intertropicales en donde son verdaderamente endémicas.

I communicate that the actual sanitary condition of the ports of Panama and Colon is in general good, as at present no epidemic disease reigns, it being well known that smallpox, yellow fever, and the paludal fevers, in their infinite varieties and forms, never are absent in these intertropical regions, where they are truly endemic.

Yellow fever is yellow fever. I have seen it at Panama, Mexico (west coast), Cuba, and in Tampa, Fla. The disinterring of the dead of yellow fever is not allowed in the British West Indian Islands. To my mind (and I make the statement as a student of the disease) Isthmian practices are directly responsible for an endless supply of yellow-fever germs. As we know, they always find a soil in newcomers. They die and the germs are committed to the earth, to be unburied *de novo*, and again are sent on their death-dealing mission. The heat, soil, and moisture of the Isthmus are ample to keep up an uninterrupted supply.

Dr. Domingo Freire, the distinguished Brazilian physician, has made prophylactic vaccinations or inoculations against yellow fever a success. As far back as 1882 he discovered in the earth of the cemetery at Sta. Isabel, in Brazil, a specific germ in the soil over the graves of yellow-fever victims. All who are familiar with that classic, "The Formation of Vegetable Mold through the Action of Worms," by the late Dr. Charles Darwin, know full well the agency of worms in bringing disease germs to the surface. Many of the germs are almost indestructible. Students of yellow fever are aware that it reached the Isthmus of Panama from the West Indies. From the Isthmus it spread up and down the coast of Central and South America and Mexico, in which it is endemic. Pray recall Dr. Quijano Wallis' official statement regarding Colombia. From the endemic centers epidemics have their origin and are further spread by steam carriers. Both coasts of Central and South America and Mexico have been swept by them. I include Costa Rica, Nicaragua, and Guatemala.

I have referred to water-borne diseases. To-day we know only too well that cholera is spread largely by water carrying the bacilius. Here pray permit me to state that during the five months that I spent in Santiago de Cuba, the oldest city in the West Indies, Dr. Urbano Guimera was conducting extensive researches, making cultures of the yellow-fever germ, etc. He found that sea water made an excellent culture fluid. In Havana I had the pleasure of examining the cultures of Drs. Carlos Findlay and Delgado. At Panama I was familiar with the excellent work done by Dr. Girerd. I am a firm believer in the protection afforded by yellow-fever inoculation; a statement made by me to Surg. Gen. Wyman in this city five years ago. My faith now as then remains unshaken. Dr. Domingo Freire has been and is a public benefactor. The unburial of the dead is not peculiar to Panama. It seems to be a Spanish-American and Spanish West Indian custom. In Santiago de Cuba the dead are taken from the bovedas. While there I photographed a number of metallic coffins that had been evicted with their contents. The quadrangle or bovedas of the city of Leon, in Nicaragua, is a large, wide and deep, well-like structure. In it were bones from evicted coffins. Such practices are vastly perilous to the human family and the world, and in the interest of humanity and common decency should end. In Cuba yellow fever is a permanent

quantity. Year by year, for nearly one hundred years, it has been deadly in Havana. It is domiciled all over that beautiful island. There are parts of Havana where the atmosphere reeks day and night with the fæcal odor. Cuba is a source of constant danger to the South. In the future, as in the past, that fair, fertile land will suffer from yellow fever. She will pay for trading with West Indian ports, where disease is generated, buried, and unburied, and liberated broadcast. The several diseases referred to are preventable diseases. Their prevalence is a blot on our scientific attainments and a disgrace to *fin de siècle* civilization.

What measures will shut out smallpox, cholera, and yellow fever? I take the liberty of answering my own question by replying, "An ideal quarantine station, or the Holt system as it exists below New Orleans on the Lower Mississippi." Therein is an effective remedy. The creation of Dr. Joseph Holt, of New Orleans, is a quarantine with whose actual workings I am familiar. It stands and ever will be a monument to the skill and clear foresight of an American sanitarian, whose name and fame are world-wide. The same system obtains at Galveston, Tex. I likewise paid it a special visit. The press of this great country has expressed much solicitude for Canada, fearing that cholera may reach the United States by that channel. As a Canadian, I may state that an ideal quarantine exists on Grosse Isle in the Gulf of St. Lawrence. Dr. Montizambert is in charge of it. It, with the Holt system, can not be improved upon. Canada will look to herself. All that care and science have indicated has been done.

While I have attempted to set forth the responsibility of Spanish America and Cuba in propagating disease, I have not forgotten cholera. For it and its pestilential centers the Far East should be called to the bar of nations. I have stated the case from my standpoint. Let us hope that measures will be devised by this Pan-American Congress to blot out these preventable diseases. Energetic action of an international character failing, the future will be but a repetition of the past and the present—disease and death!

PESTILENTIAL CONDITIONS.

By A. N. BELL, A. M., M. D.

Modern sanitation, as undertaken in England fifty-five years ago, was based upon the recognition of the relation of local conditions to the death rate of the people; and the coincidence of its practice and the progressive reduction of the death rate ever since is the unanswerable argument for the establishment of sanitary methods everywhere. Indeed, the scientific investigation of preventive medicine essentially depends upon the registration of the causes of death. The year 1838 was the first complete registration of births, marriages, and deaths, including the registration of the diseases which were the causes of death, in England. It was the beginning of the sanitary movement in that country. Hitherto it had been the almost universal practice there, as elsewhere, when and wherever a pestilential disease broke out in a community to attribute it to a foreign source. During the most devastating epidemic of which we have any reliable history that ever prevailed—that which swept through Europe and northern Asia about the middle of the fourteenth century—the people were content and even encouraged to live without regard to personal cleanliness; to dwell in unventilated houses, on swampy ground bestrewn with putrescible material of all kinds; and to consume tainted food and drink foul water, while the communities severally berated one another and instituted quarantines for protection from pestilences which they all alike cultivated. "Plague" had been universally identified with Egypt up to that period, as it was for several centuries thereafter; and, though not always of the

same type, it was scarcely less common in England and in several European countries than it was in Egypt. The descriptions of the pestilential condition of London, by Erasmus, early in the sixteenth century, and of Cairo, by Volney, nearly two centuries later, are here incorporated as illustrative examples of conditions whose record should never be lost, and which may well be held up as object lessons to some communities in the present generation. Erasmus, of Holland, during a temporary residence in London, wrote to Dr. Francis, the physician of Cardinal Wolsey, minister to Henry VIII, as follows:

I often wonder, and not without concern, whence it comes to pass that England for so many years hath been continually afflicted with pestilence, and, above all, with the sweating sickness, which seems in a manner peculiar to the country. We read of a city which was delivered of a plague of long continuance by altering the buildings according to the advice of a certain philosopher. I am much mistaken if England, by the same method, might not find a cure. First of all, they are totally regardless concerning the aspect of their doors and windows to the east, north, etc.; then they build their chambers so as not to admit a thorough air, which yet, in Galen's opinion, is very necessary. They glaze a great part of the sides with small panes, designed to admit the light and exclude the wind, but these windows are full of chinks, through which enters a percolated air, which, stagnating in the room, is more noxious than the wind. As to the floors, they are usually made of clay, covered with rushes that grew in fens, which are so slightly removed now and then that the lower part remains sometimes for twenty years together, and in it a collection of spittle, vomit, urine of dogs and men, beer, scraps of fish, and other filthiness not to be named. Hence, upon change of weather a vapor is exhaled very pernicious, in my opinion, to the human body. Add to this that England is not only surrounded by the sea, but in many parts is fenny and intersected with streams of brackish water, and that salt fish is the common and favorite food of the poor. I am persuaded that the island would be far more healthy if the use of these rushes were quite laid aside and the chambers so built as to let in the air on two or three sides with such glass windows as might be either thrown quite open, or kept quite shut, without small crevices to let in the wind; for as it is useful sometimes to admit a free air, so it is sometimes to exclude it. The common people laugh at a man who complains that he is affected by the changeable and cloudy weather; but for my part, for these thirty years past, if I ever entered into a room which had been uninhabited for some months, immediately I grew feverish. It would also be of great benefit if the lower people could be persuaded to eat less of their salt fish, and if public officers were appointed to see that the streets were kept free from mud, and that not only in the city, but in the suburbs. You will smile, perhaps, and think that my time lies upon my hands, since I employ it in such speculations, but I have great affection for a country which received me so hospitably for a considerable time, and I shall be glad to end the remainder of my days in it if it be possible. Though I know you to be far better skilled in these things than I pretend to be, yet I could not forbear from giving you my thoughts, that, if we are both of a mind, you may propose the project to men in authority, since even princes have not thought such regulations to be beneath their inspection.[1]

Though England was at that period among the most advanced of civilized nations, the admonition was of no, or at most of but little, avail. Some nominal "sewers" were constructed, but with a prohibition of all connection with them by house drains, or drains from water-closets or cesspools, under severe penalties. Concessions were provided for, however, as special privileges, so that if a man wished to take measures for the protection of the health of himself and family, he could do so only under special favor. Moreover, every builder built according to his own fancy, and houses continued to be "run up" without the slightest regard to drainage or decency, and under the restriction of a tax on light. That pestilential diseases continued under such conditions, and even until nearly two centuries later, to rival those of the Middle Ages in other centers of population, is perfectly consistent with the abundance of such material as they are now known to depend upon. The description of the conditions of plague by Volney, as witnessed by him at Cairo in 1783, more than a century subsequent to the great plague of London, is good for

[1] Malcolm's London, p. 459

all time. The people were crowded in close, small, damp dens, thick with the odors of their own impurities and those of the heated marshes. Their food was scanty and unwholesome, cooked over fires with dried manure for fuel. Ignorance, despotism, and poverty combined to make them in every respect a degraded people; but one good custom obtained, which the practice of better conditioned Oriental nations had communicated to them; this was the burial of their dead outside their towns. It was thus that, when the pestilence raged, he was able to count the removal of 1,500 corpses daily out of Cairo. The attack was accompanied by a famine, from a deficient inundation of the Nile, and the European was shocked as he passed through the streets by the dead lying here and there: and the living, who had scarcely life enough to be distinguished from the dead, imploring the passer-by for relief.[1] The conditions of cholera in India at the present time, and as they seem to have been maintained from our first practical knowledge of them—gained by the commercial relations of that country with other countries which were and still are found to maintain approximate conditions—rival the conditions of the sweating sickness in London and of the plague in Cairo. According to the official reports of Dr. M. C. Furnell, sanitary commissioner at Madras:

In all India there died during 1879 5,000,000 people, of whom fever killed 3,500,000; cholera killed off 265,000. In some years it is much worse than this. A good deal of this mortality is preventable, and the use of impure water is, I feel persuaded, answerable for much of it. When the cholera was making its way down from the northwest to our presidency at the end of 1881 and the commencement of 1882, I was asked by an energetic collector to send him a few simple rules on sanitation of villages, that he might publish them in his district Gazette. Subsequently I found myself inspecting a municipality in the north, and the manager showed me a resolution calling attention to my circular, and resolving that two important tanks, which I will call tanks A and B, should be strictly set aside for drinking purposes, and a policeman set over each to prevent people washing their bodies and clothes therein. I confess I felt very pleased and proud when I read this; I felt that we were getting on. Next morning I was going round the town, when the manager pointed out in the distance a tank, which he said was the bund of tank A, one of the tanks in which washing of clothes and bodies was strictly prohibited. "Oh," I said, "let us go and look at it." We went. The doctor of the station and the manager of the municipality were with me. We were soon there, and it was certainly a magnificent tank. There were crowds of people at all four sides, and all or nearly all busily engaged washing their clothes, and those that were not doing that were bathing their bodies! The expression on the face of my friend, the manager, when he saw all this, was slightly ludicrous. Just where we had reached the tank was an old man washing a not very clean cloth, and when he had done he washed himself and spat repeatedly in the water. He then went away, and within a minute a woman came there, stood almost in the identical spot the old man had stood a minute before, and filled two bright chatties with the water and took them home for drinking and cooking. She must of necessity have taken home some of the filth from the old man's clothes and a portion of his spittle to drink and cook with! What a repulsive idea! Now, what we have just seen passing under our eyes was taking place at various times of the day all round the tank, and not only all round this tank, but around the hundreds and thousands of tanks which are scattered over this fair continent of India. And this being the case, can we wonder for a moment at the rapidity with which an epidemic of cholera spreads through a community when once it makes its appearance in their midst? And yet how simple is the remedy! * * * I do not by any means maintain water is the only means by which cholera is spread. * * * I believe the air, clothes, food, especially drink of all sorts, besides water, may and do spread it; but I also believe that water is the chief means by which it is spread, especially in India, and that it is on account of the peculiar treatment water obtains in this country that India is the only country in the world subject to such frequently recurring and such terrible epidemics of this dread scourge.[2]

All the literature of good observers on cholera in India, and the leading conditions of its introduction into other countries during the ten years' interval since

[1] Voyage en Syrie et en Egypte, Vol. I, p. 175.

[2] Cholera and Water in India, by M. C. Furnell, M. D., F. R. C. S., Companion of the Indian Empire; Fellow of Madras University; late Surgeon-General and Sanitary Commissioner, Madras, etc. London, J. & A. Churchill, 1887.

the report of Dr. Furnell, confirm his observations. But besides cholera, the relation of the same conditions to other pestilential diseases should be kept in view. The report of the Madras municipality for 1891–92 affords equally striking evidence of this relation. The death rate of the city of Madras for the year 1891 was 52.6 per 1,000 of the population. Of the 23,808 deaths which occurred that year, 66 were due to smallpox, 372 to measles, 6,731 to fevers, 4,573 to bowel complaints, and 1,916 to cholera, making a total of 13,658 from these causes, or 57 per cent of the whole; 5,843 were of infants under 1 year, being 437 per 1,000 of the population, or 30.19 of the children born alive. The explanation of these terrible figures is given in the report as follows:

An indifferent water supply, defective drainage, and over a considerable portion of the municipality no drainage at all, a porous soil loaded with organic impurity, a putrid and fluctuating subsoil water rising comparatively near the surface, want of open spaces in some parts of the town, crowded parcherries (villages) for the poor, overcrowded and ill-ventilated houses for the middle class (in many cases directly connected with the subsoil), water by wells in their interior, burial grounds and slaughter-houses in the city, and, lastly, the general social, conjugal, and religious habits and customs of the people.

In the district of the town in which the mortality was highest the unsanitary conditions are described as ghastly. "The first division, with a mortality of 72.8 per 1,000, contains some of the largest parcherries in the municipality, with wretched huts huddled together, in some cases on a soil that after a shower of rain forms a slough of liquid filth." The third division, with a death rate of 56.7, "has narrow streets of overcrowded and badly ventilated houses, most of which have wells in their interior connecting them with the subsoil water, which is here very putrid." It is in these divisions that the highest death rate from cholera occurred. The conditions of yellow fever are well known to comprise a high temperature, 70° F. and upward, in addition to the conditions common to pestilential diseases. As comprising these conditions in a concentrated degree, corresponding, more or less, with my own observations at Vera Cruz and other Mexican ports, several Central American and West Indian ports, seaports on the west coast of Africa, and at Memphis and New Orleans, in the United States, I quote a description of Havana in 1892, by Dr. Erastus Wilson, who has been a resident of that city for a number of years:

Havana occupies a peninsula formed by the Gulf of Mexico on the north and injutting of our bay or harbor on the east and south, terminating on that side in various lagoons and lowlands, through which several creeks meander and enter the bay in its shallow margins. Our slaughter-houses on one of these pours its blood and offal into these sloughs. In its topography its streets have not been constructed to regular grades, but have followed the original surface in various altitudes. A large proportion of our streets are yet unpaved, and in the poorer wards it is a common custom to throw slop water into the streets, where it frequently forms stagnant pools that fester in the sun and exhale noxious vapors. A clayey subsoil underlies its surface, and its habitations, without cellars, are in direct contact with its undrained, humid soil, without damp-proof courses to protect their walls from moisture, and these are regularly saturated and discolored with it 5 or 6 feet above the ground floors. The city has no system of sewers, and the night soil is almost universally accumulated within the rear part of the houses in the old midden closet, which is simply a hole in the ground, mostly without lining, and consequently its bottom and sides are permeable by the filth, and which, dissolved by the house slops and other domestic waters, soaks into the ground farther and farther, until the entire foundations of the houses are reeking and pestilent with these organic infusions, undergoing putrid fermentations and exhaling their death-dealing gases and microbes within all the habitations. Moreover these pestilential closets are usually adjoining the kitchens, and in near proximity to the sleeping apartments, which, in the houses of the poorer classes, are very imperfectly ventilated; and it is an inveterate custom of the people to close them persistently on the first approach of sickness, and particularly of febrile symptoms, heedless of professional advice to the contrary. Along the harbor side of the city wooden wharves are built upon piles, and several of the streets that descend to the bay have, loosely constructed with flat stones or bricks and lime

mortar, square drains of 1 foot, more or less, in size, and connecting their houses with them by similar conduits of smaller size, have set water-closets, and in this way, during many years, these conduits—by many called "sewers"—have been accumulating deposits of sewage, less than 3 feet under the surface of the streets, distributing their infiltrations, and pouring out some portions of them into the bay, which accumulate as pestilential mud under the wharves. Thus our population, familiarized with this state of uncleanliness, are exceedingly careless in their methods of collecting their garbage, and possessing no public urinals, all these organic materials are spread about, and our abundant rains, at certain seasons, wash them into the low belt along the harbor. I have copied brief mortuary statistics of some of the affections that produce the highest death rates here, as follows: Out of our population of 200,000, I select the statistics of ten diseases that produced highest death rates in Havana in 1890 and 1891, in the order of their death rates, respectively: Pulmonary tuberculosis, 1,375, 1,384; lesions of heart and aorta, 633, 654; enteritis, 784, 579; pneumonia and bronchitis, 451, 429; yellow fever, 340, 349; cerebral congestion and haemorrhage, 306, 291; meningitis, 298, 238; liver affections, 215, 197; pernicious fever, 164, 185; typhoid fever, 223, 172; smallpox, 12, 151.[1]

Typhus fever finds its conditions in dirt, privation, overcrowding, and cool or cold weather; conditions, excepting the last named, nearly identical with Oriental plague, of which disease, indeed, some observers regard it as being only a different type. "Jail fever," "hospital fever," "putrid fever," and "ship fever" are its synonyms, and each one of these names suggests the conditions of its development, to which is added contagiousness proportional with their concentration. It would be an easy matter to multiply quotations from the history of pestilential diseases, with which all sanitarians are familiar, and to adduce numerous examples of approximate conditions when and wherever such diseases have prevailed in the United States, as elsewhere; particularly of the relations of a dirty soil and polluted water to the prevalence of typhoid fever and other intestinal diseases, not considered pestilential; but which, if estimated by their only true standard, the mortality from them in communities habitually subject to such conditions, is really more pestilential than any of the diseases against which quarantine restrictions are exercised, while the conditions which sustain them are those above all others most favorable to the introduction of cholera. It has been observed that in the several visitations of cholera to England "it has generally attacked those towns and houses which offered to it the best inducements to visit them in their filth, decaying refuse, crowded and dirty population, bad water, damp, polluted subsoil, or any other of those conditions which lead to bad health in a population, and which, when cholera is absent, afford an evidence of their existence by the prevalence of scarlet fever, smallpox, typhoid, and other fevers, measles, "whooping cough," etc.,[2] to which diphtheria should be added as one of the most devastating of the group. Yet there are many communities that habitually indulge the conditions of these constantly recurring pestilential diseases, with which they have grown familiar, with never a thought apparently that the same conditions are a perpetual menace to the introduction, or it may be the revival, of the less common and exceptionally devastating pestilences. At the very time of writing this paper, my attention was arrested by a press announcement of an official report of the governor-general of Turkestan, which has recently been published in St. Petersburg, that that province has been severely visited by an epidemic of "black death," which followed on the footsteps of cholera. It appeared suddenly at Askabad, and in six days killed 1,303 persons in a population of 30,000. "Black death" has long been known historically as a once common, deadly pestilence, which, like some other pestilences, superficial students have been wont to consider extinct. But the more attentively pestilential diseases are studied from the earliest records of them to the present time, the more evident it appears that not a single one of them has ceased to exist. The same and all exist to-day that ever

[1] Florida State Medical Society Transactions, 1892.

[2] Douglas Galton, C. B., D. C. L., etc., Journal of the Society of Arts, November 19, 1886.

have existed, and they are equally liable to occur again and again under favoring conditions.

My purpose in the foregoing quotations and interjections has been to emphasize the relation of pestilential diseases to the putrefaction of organic matter, the conditions which arrest, nourish, and propagate bacteria. Every student knows that the first bacterium ever discovered was in a drop of putrid water by Leeuwenhoeck, in 1675; but it was the discovery of no new thing. In the progress of bacteriological knowledge we have learned that bacteria are essential to the putrefaction of organic matter; that the existence of bacteria, therefore, is coëxtensive with putrefying material in time and place from the beginning, and that wherever putrescible matter exists; on the surface of the earth, in the soil or water, or in the air; there bacteria abound. But notwithstanding this beneficent function of bacteria, putrefaction, the process by which dead organic matter containing nitrogen is converted into food for plants, diligent investigation of their nature under divers circumstances has shown them to be, like other great tribes of plants, divisible into genera and species more or less antagonistic to each other, and that some of them are parasites dangerous to mankind and animals; these are the pathogenic germs of pestilential diseases; but, like the rest, they depend upon putrescible material for support and propagation. Like all living things, bacteria grow only at the expense of the food which they consume. Their viability depends more or less upon the presence of oxygen, though some can do without it; the presence or absence of moisture; the degree of temperature; the presence or absence of other agencies; antiseptics, germicides, etc.; and doubtless some conditions beyond our conception. But the spores of bacteria, the seeds, are, of all things viable, the most persistent. Indeed, so long as they do not germinate, do not encounter congenial conditions for development, so far as time is concerned, in the absence of destructive agencies, the spores of bacteria are practically immortal. They everywhere abide putrescible matter containing nitrogen, as their condition of development, maturity, and propagation. Hence, however true it may be that the adult microbe of cholera or that of any other disease may be destroyed by desiccation, or by sprinkling with some disinfecting solution, or that it is portable only by means of moist material, and not liable to be conveyed by clothing or rags, or borne on the wings of the wind; all such conditions are void when applied to the spores. I am aware that the cholera bacilli and some other pathogenic bacteria are devoid of spores, that they propagate exclusively by fission; yet even these are endowed with singularly enduring qualities, depending upon favorable conditions for vegetation. Moreover, as other vegetable organisms have their seasonal adaptations and favorable climates, so certainly have bacteria; and so, too, their spores or seeds, like the germs or seeds of other plants, may be quickened in unusual places under exceptional seasons. For example, typhus fever never prevails in warm climates, nor yellow fever in cold; yet all observers are familiar with the occasional occurrence of these diseases contrary to their habitats. Typhoid fever is well known to be a late summer and autumnal disease in temperate climates, yet the artificial climate of the dwelling often proves suitable to its development, when the germs are present. Moreover, of this disease in particular, like cholera, foul water is very far from being the only means of its distribution. The dust of dried excreta is ever liable to be carried in the air, to lodge in food or drink, and to be swallowed; and, with regard to the viability of the germ in the soil, Dr. S. Monckton Copeman cites the following case:

A man who had acquired enteric fever elsewhere brought it to a village. His evacuations were buried in the dung heap. Some weeks later five persons engaged in removing some of the dung were attacked by the disease. Their discharges were sunk deep in the heap. At the end of nine months it was completely cleared out by two workmen, one of whom fell ill of enteric fever and died.[1]

[1] Treatise on Hygiene, Stevenson and Murphy, Vol. I, p. 334.

Enormous numbers of bacteria have been found in the soil by various observers. Infusions made from manural, field, and garden earth, even though diluted a hundred times or more, still contain thousands of bacteria in every drop; and the soil and dust of streets always contain large numbers. Naegeli and Buckner demonstrated several years ago that the porous soil of the earth will yield germs existing in it to ascending currents of the air even when wet; which fact has a strong bearing upon the significance of the soil in the spreading of infectious diseases generally.[1]

Beumer, in experimental researches for bacteria in the soil, in 1886, obtained from a specimen of sandy humus taken from the depth of 3 meters, 45,000,000 to the gram; at 4 meters, 10,000,000; at 6 meters, 5,000,000. These specimens were obtained from the vicinity of hospitals at Greifswald. In a churchyard, at a depth of 4 meters, the number in one experiment was 1,152,000, and in another, 1,278,000.[2]

Frankel also has given special attention to the examination of undisturbed soil not in the immediate vicinity of dwellings.

The most important fact developed by Frankel's researches is that in virgin soil there is a dividing line at a depth of from three-quarters to one and one-half meters, below which very few bacteria are found, and that consequently the "ground-water region" is free from microörganisms, or nearly so, notwithstanding the immense numbers present.[2]

But neither of these investigators say anything about the kind of bacteria they found.

Manfredi has recently (1892) published the results of his extended investigations relating to the dust in the streets of Naples. The number of bacteria varied greatly in different parts of the city. In streets where the traffic was least and hygienic conditions the best the average number was 10,000,000 per gram. In dirty and busy thoroughfares the average was 1,000,000,000, and in certain localities the number was even five times as great as this. Injections into guinea pigs gave a positive result in 73 per cent of the animals experimented upon. Among the known pathogenic bacteria obtained in this way were the pus cocci (in eight), the bacillus tuberculosis (in three), the bacillus of malignant edema, and the tetanus bacillus.[3]

According to the investigations of Grancher and Richard, in 1889—

The superficial strata of the earth are exceedingly rich in pathogenic germs; at a certain depth there is a limit beyond which the number of germs rapidly diminishes, until they cease altogether. In the deep strata of the bacilliferous zone pathogenic species do not exist. Grancher and Deschamps have observed the arrest of the typhus bacillus at a depth of 50 centimeters. In the cultivated superficial strata there are fewer micrococci than bacilli. The bacilli exist in the soil chiefly as spores. Under this form they best resist destructive agents and remain latent for years, retaining their virulence. It is probable that the pathogenic bacilli germinate in the soil.

The cholera bacilli form numerous colonies at a depth of 3 meters during the months from August to October; from April to June, at a depth of 2 meters, there is no development, while at a depth of 1½ meters the bacillus vegetates. At least 2 per cent of humidity is necessary for the development of the germs. Soil rich in organic material is most favorable to this development. Causes of death of the pathogenic germs exist in the soil. The principal cause is desiccation. Koch and Duclaux have demonstrated that this is especially hurtful to the micrococci, and here, according to Koch, is the explanation of the fact that micrococci are relatively rare on the superficies of the soil. The cholera bacillus dies rapidly under exsiccation. Netter fixes three weeks as the extreme limit at which the exsiccated pneumococcus preserves its virulence.

The two most potent causes of destruction which the microbes encounter are the saprophytic bacilli and solar light. The saprophytic bacilli are in continual strife with the pathogenic microbes, and have generally the advantage. The bacillus of tetanus is exceptional, and may develop favorably in the presence of other species. Solar light is injurious to very many bacilli. According to Duclaux it is the

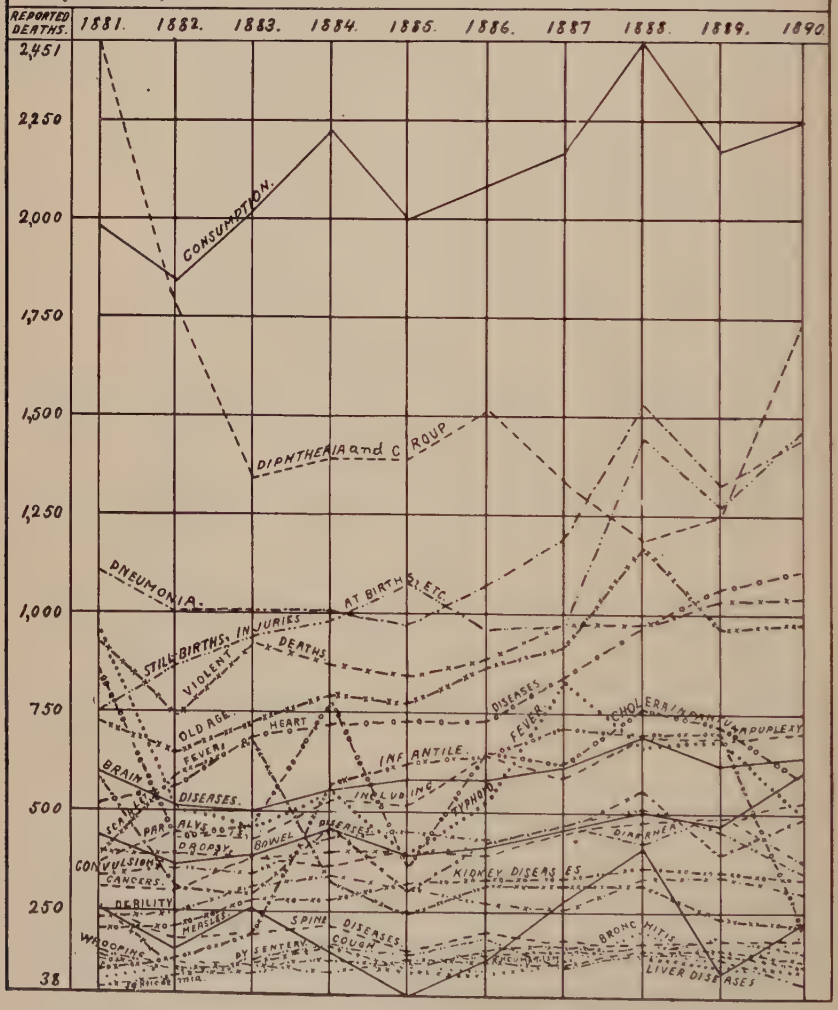
[1] Centralblatt f. d. Med. Wissenschaften, No. 29, 1882.

[2] Treaties on Hygiene, Stevenson and Murphy, Vol. I, p. 334.

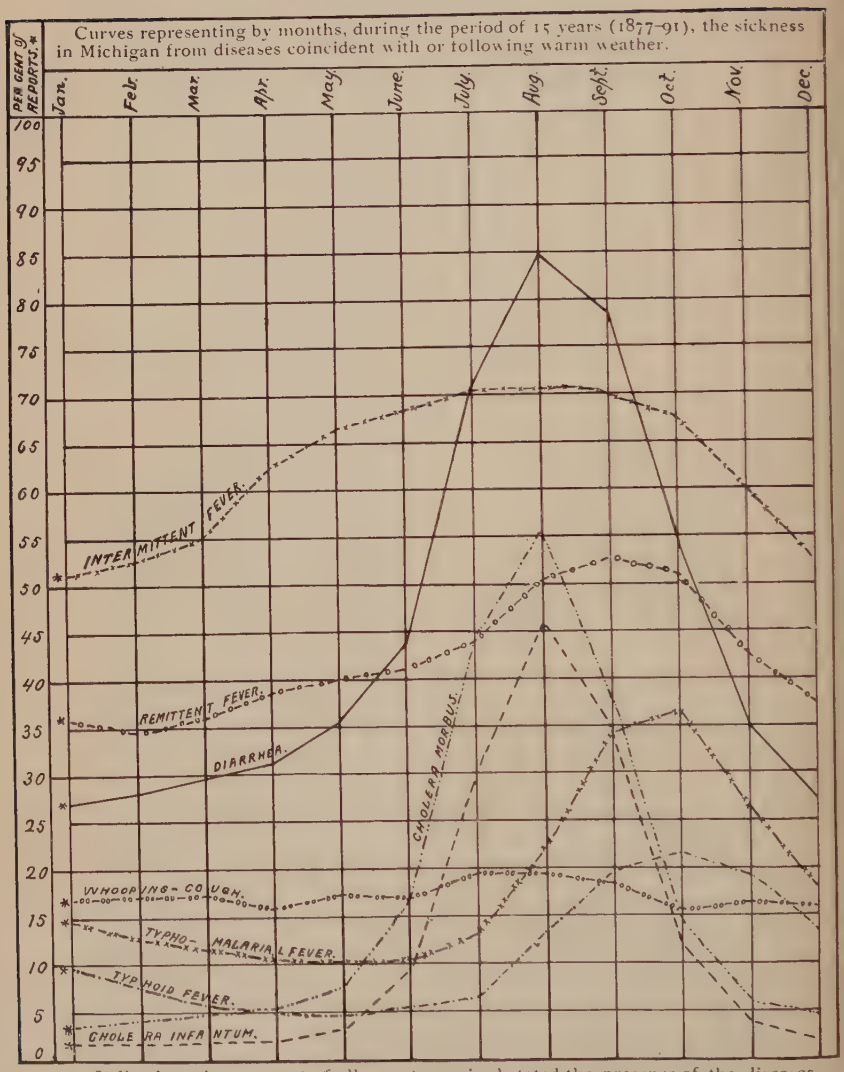
[3] Manual of Bacteriology, by George M. Sternberg, Colonel and Surgeon U. S Army, etc., pp. 570, 571.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.

No. 1.—Relative importance of and fluctuations in the reported mortality from each of the twenty-eight greatest causes and conditions of deaths in Michigan during the ten years 1881–90.



MICHIGAN STATE BOARD OF HEALTH EXHIBIT.

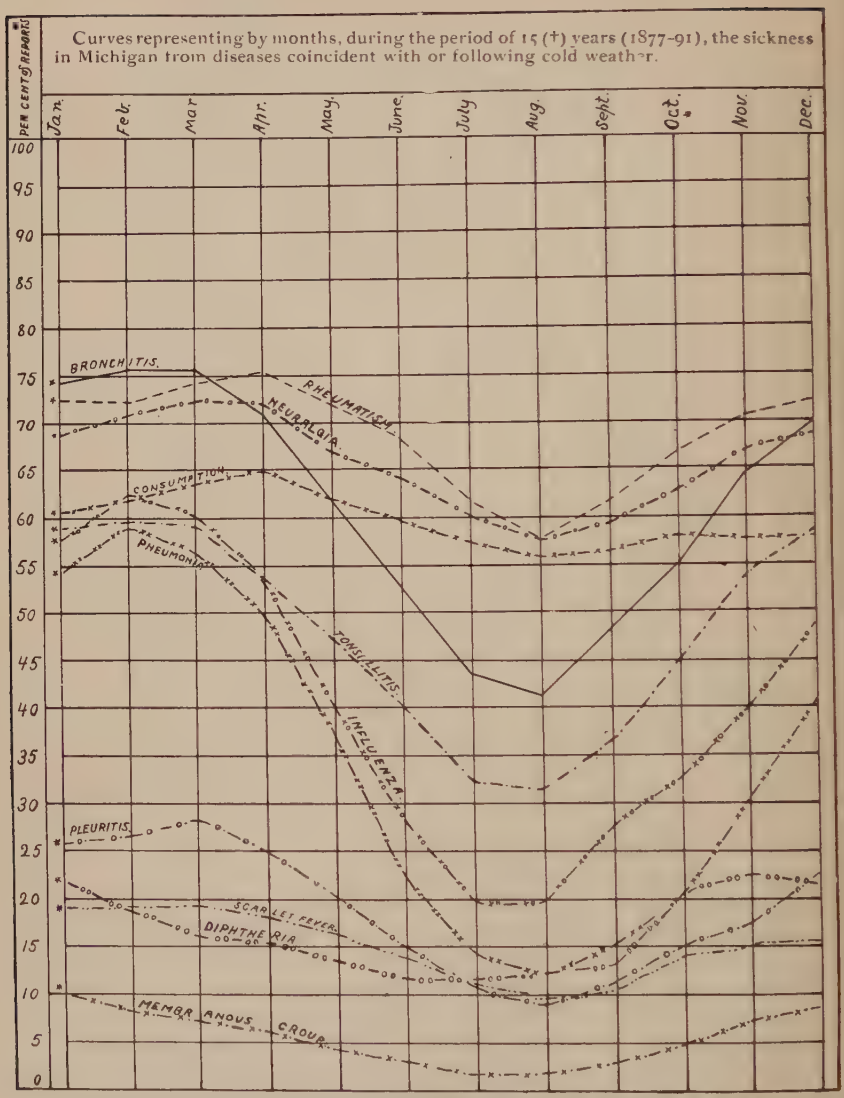


* Indicating what per cent of all reports received stated the presence of the diseases named then under the observation of the physicians reporting.

Relative to each disease over 63,000 weekly reports are represented in this diagram.

No. 2.—WARM-WEATHER DISEASES IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.

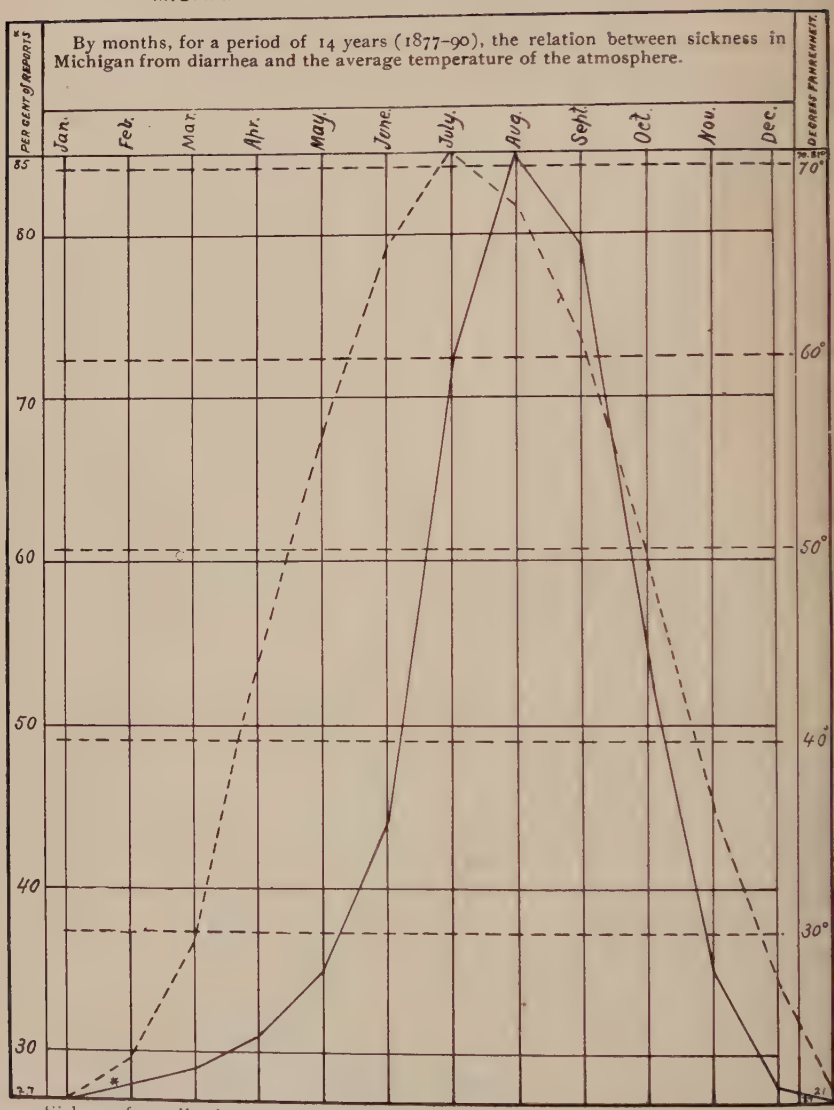


* Indicating what per cent of all reports received stated the presence of each disease then under the observation of the physicians reporting. Relative to bronchitis, pneumonia, membranous croup, diphtheria, influenza, scarlatina, and rheumatism, over 63,000 weekly reports; relative to neuralgia and tonsillitis over 57,000; relative to consumption over 60,000, and relative to pleuritis over 19,000 weekly reports of sickness are represented in this diagram.

† Consumption for only 14 years, tonsillitis and neuralgia for only 13 years, pleuritis for only 4 years.

No. 3.—COLD-WEATHER DISEASES IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



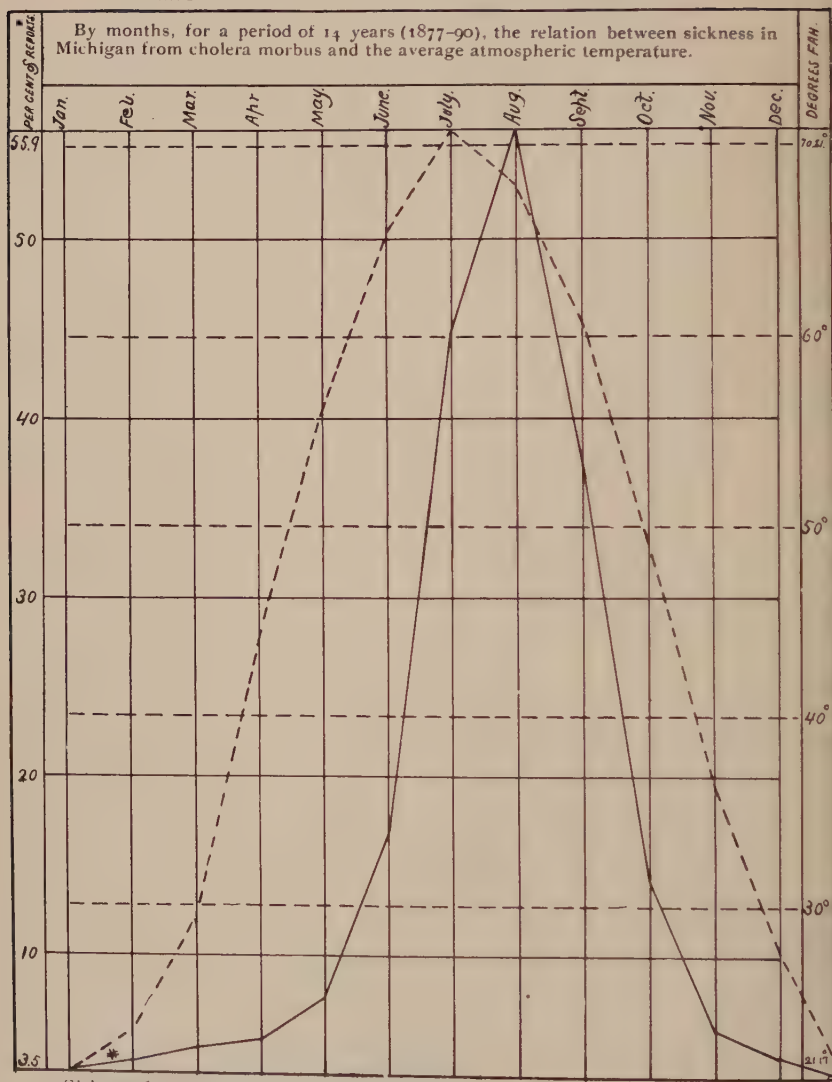
Sickness from diarrhea ———————. Average temperature — — — — — —.

* Indicating what per cent of all reports received stated the presence of diarrhea then under the observation of the physicians reporting.

Over 59,000 weekly reports of sickness and over 256,000 observations of the atmospheric temperature are represented in this diagram.

No. 4.—ATMOSPHERIC TEMPERATURE AND SICKNESS FROM DIARRHEA IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



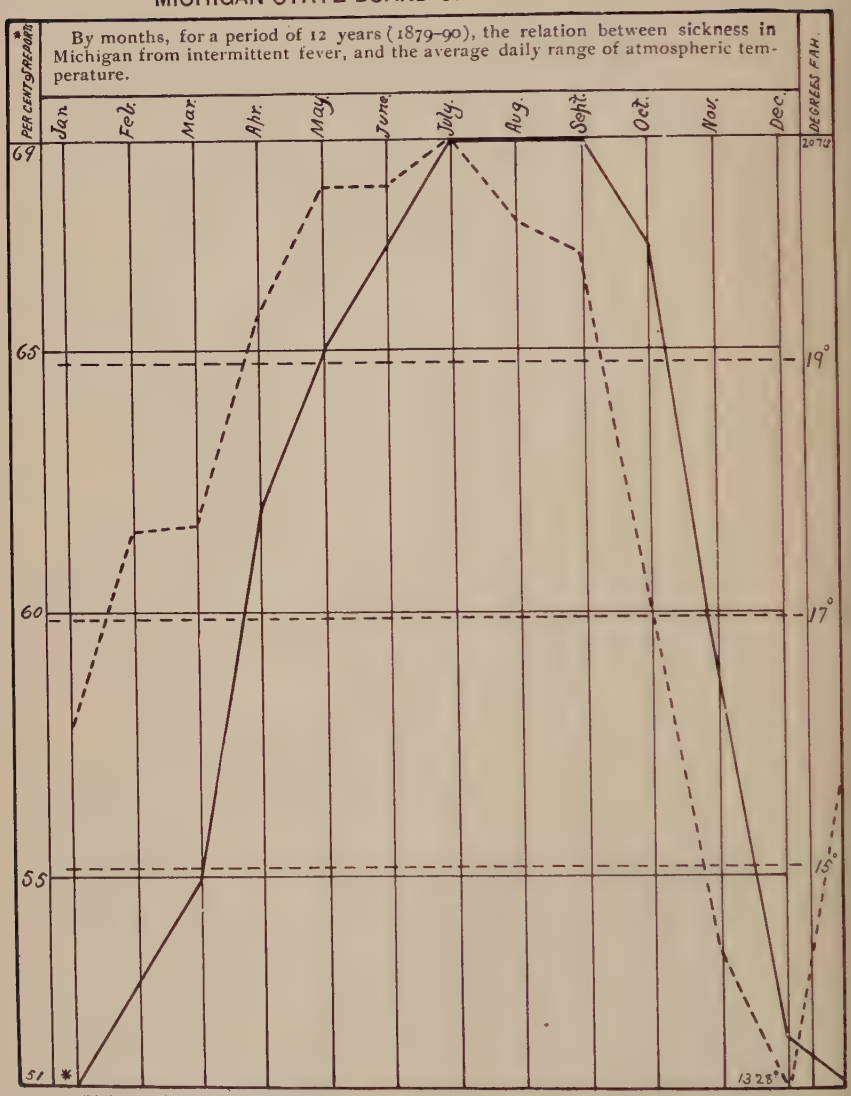
Sickness from cholera morbus ———————. Average temperature – – – – – – –.

* Indicating what per cent of all reports received stated the presence of cholera morbus then under the observation of the physicians reporting.

Over 59,000 weekly reports of sickness and over 256,000 observations of the atmospheric temperature are represented in this diagram.

No. 5.—ATMOSPHERIC TEMPERATURE AND SICKNESS FROM CHOLERA MORBUS IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



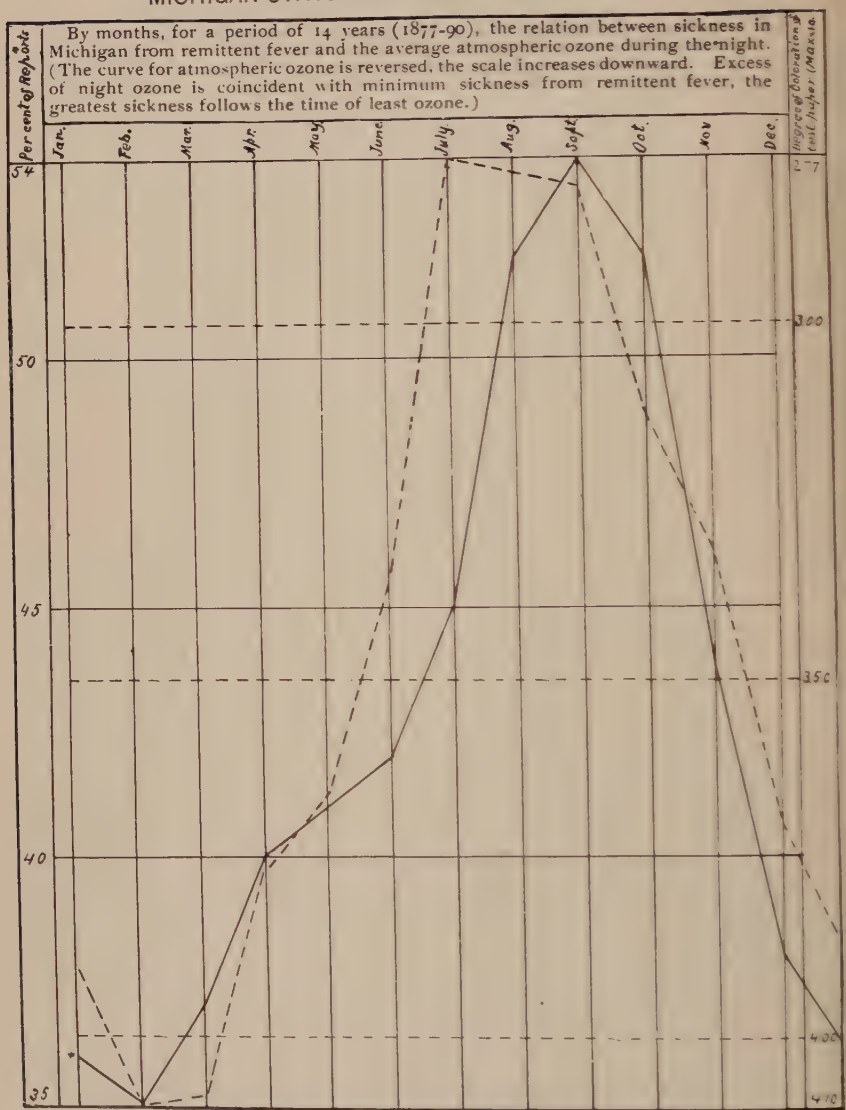
Sickness from intermittent fever _____. Average daily range of temperature — — — — — — — — .

*Indicating what per cent of all reports received stated the presence of intermittent fever then under the observation of the physicians reporting.

Over 53,000 weekly reports of sickness and over 60,000 observations of the average daily range of atmospheric temperature are represented in this diagram.

No. 6.—DAILY RANGE OF ATMOSPHERIC TEMPERATURE AND SICKNESS FROM INTERMITTENT FEVER IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.

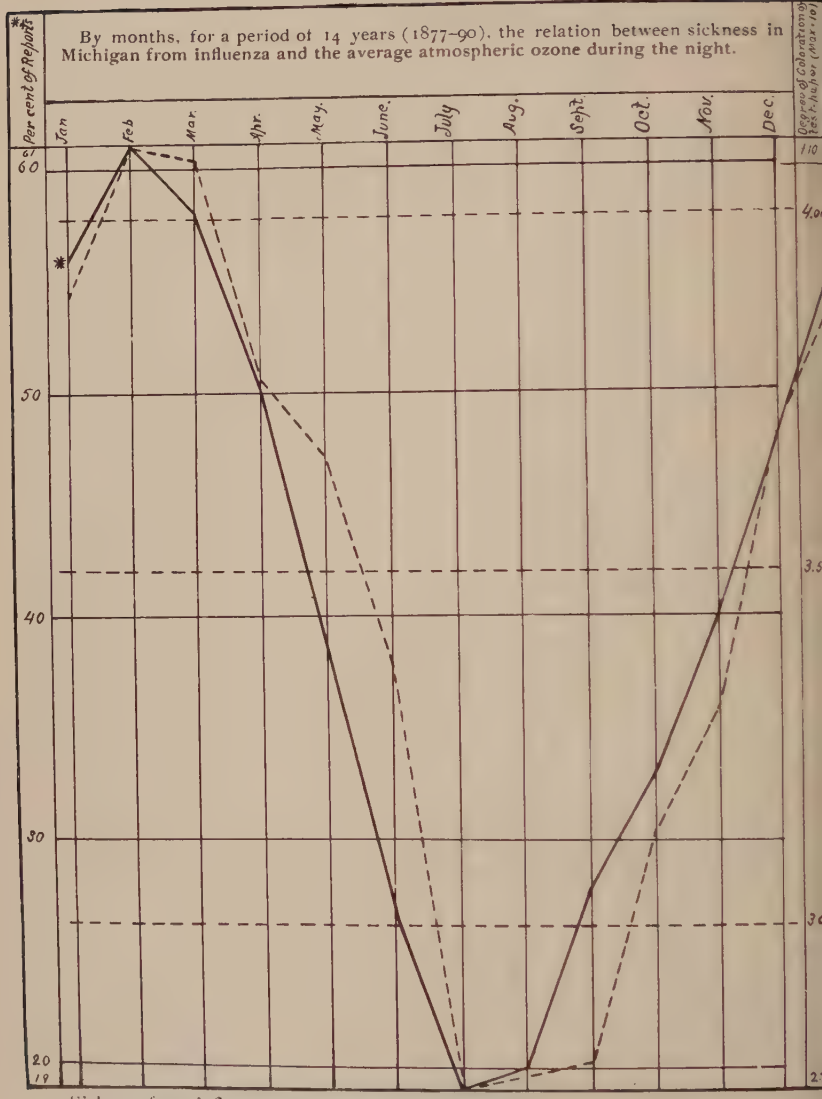


Sickness from remittent fever———————. Atmospheric ozone, night – – – – – – – –

* Indicating what per cent of all reports received stated the presence of remittent fever then under the observation of the physicians reporting.

Over 59,000 weekly reports of sickness and over 69,000 observations of atmospheric ozone are represented in this diagram.

No. 7.—ATMOSPHERIC OZONE AND SICKNESS FROM REMITTENT FEVER IN MICHIGAN.



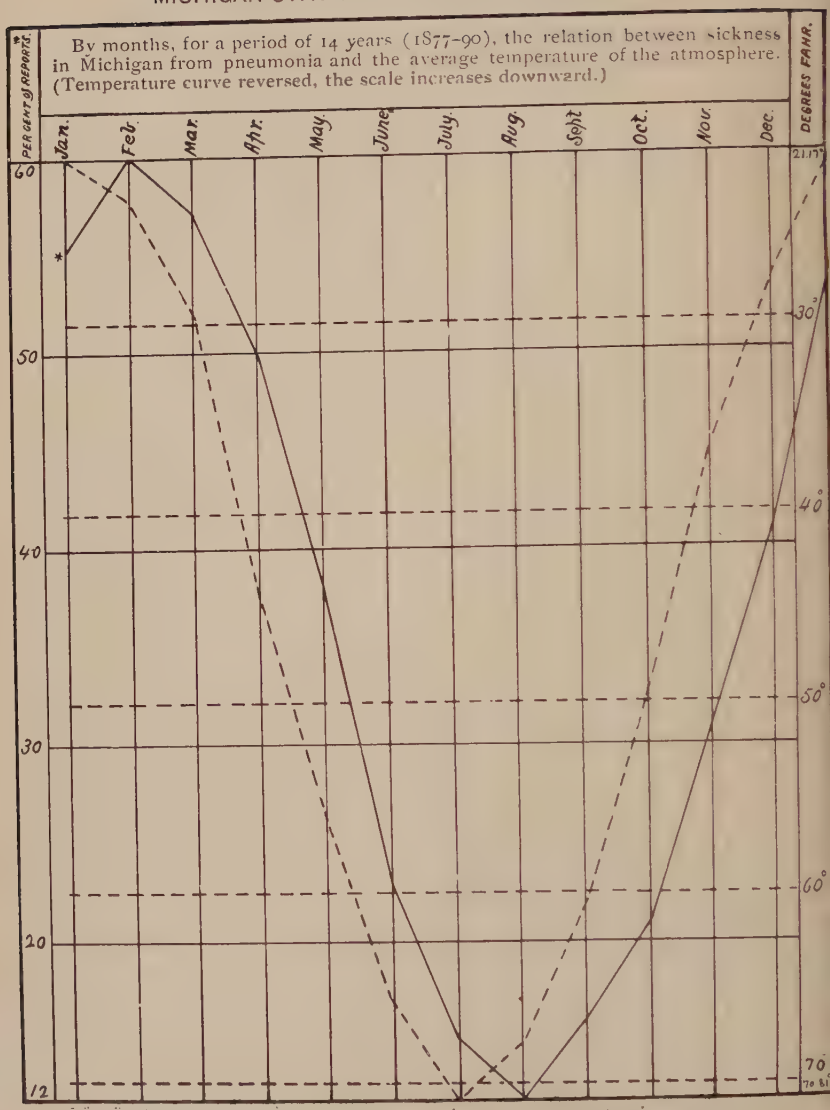
Sickness from influenza ———————. Atmospheric ozone, night — — — — — —.

* Indicating what per cent of all reports received stated the presence of influenza then under the observation of the physicians reporting.

Over 59,000 weekly reports of sickness and over 69,000 observations of atmospheric ozone are represented in this diagram.

No. 8.—ATMOSPHERIC OZONE AND SICKNESS FROM INFLUENZA IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



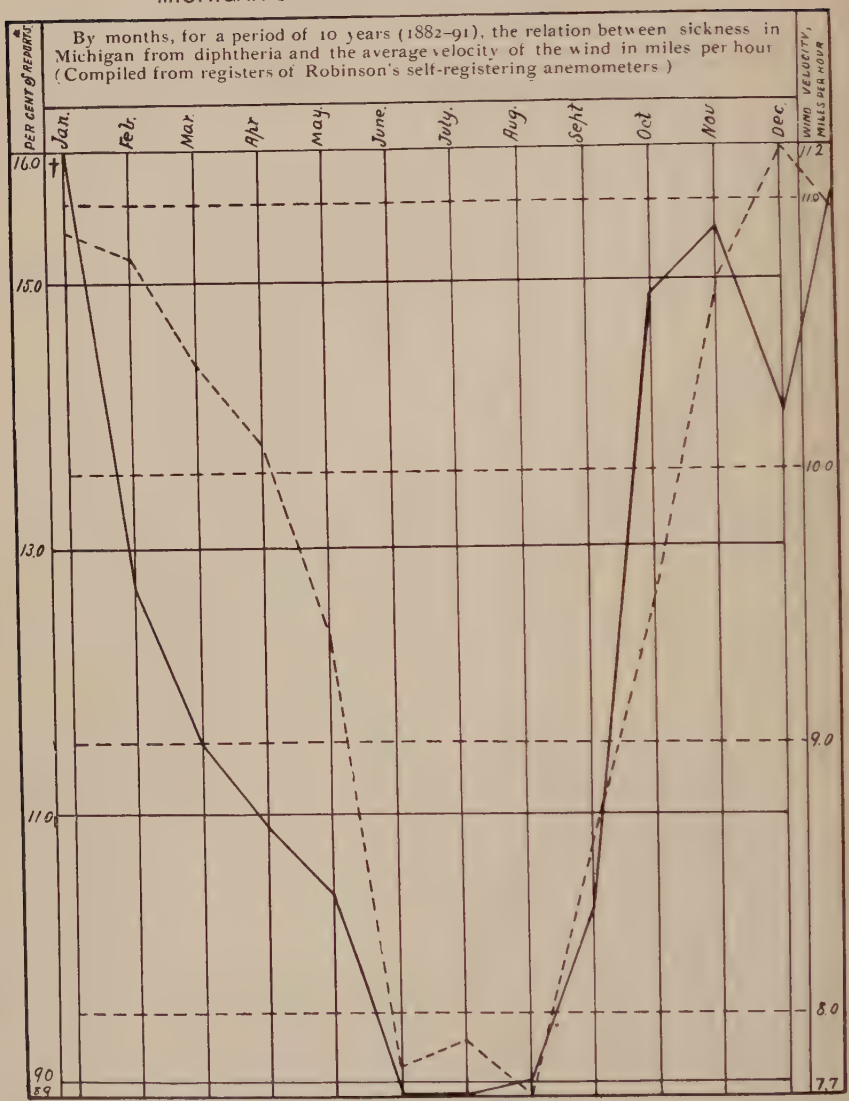
Sickness from pneumonia ———————. Average temperature — — — — — — —.

* Indicating what per cent of all reports received stated the presence of pneumonia then under the observation of the physicians reporting.

Over 59,000 weekly reports of sickness and over 256,000 observations of the atmospheric temperature are represented in this diagram.

No. 9.—ATMOSPHERIC TEMPERATURE AND SICKNESS FROM PNEUMONIA IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



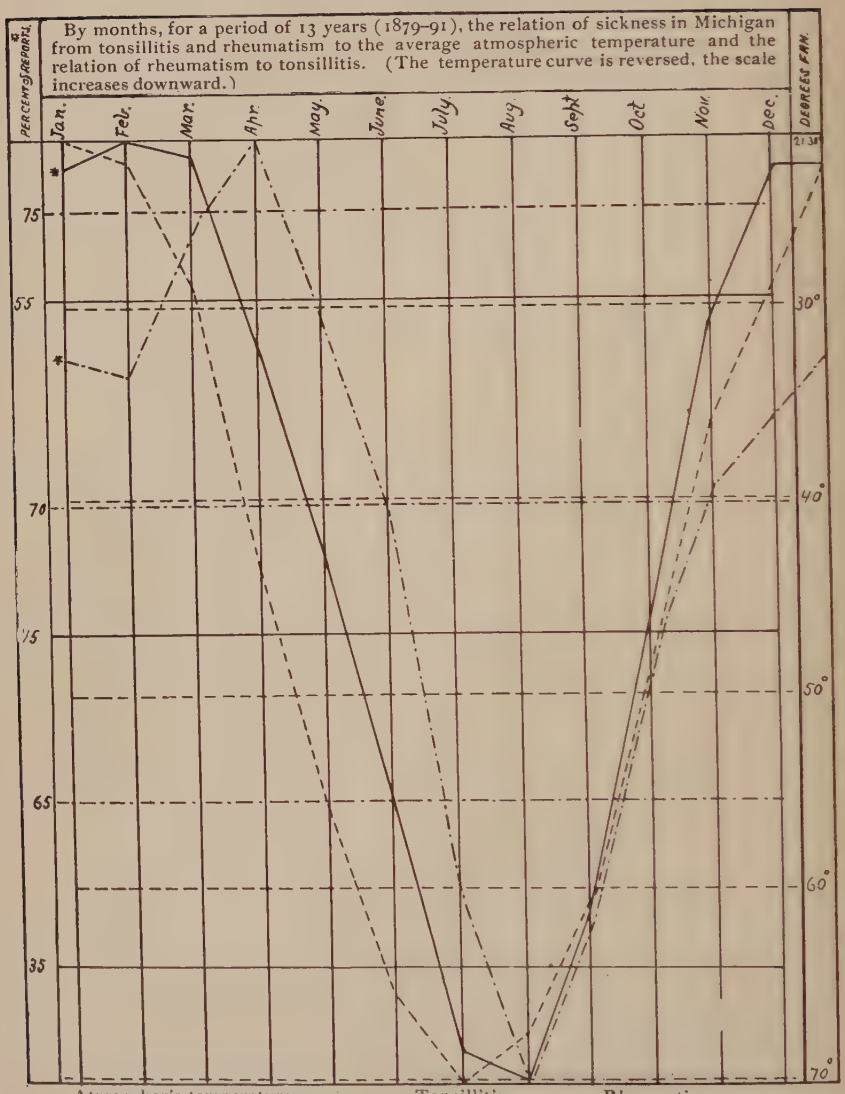
Diphtheria ———————————. Velocity of the wind — — — — — — —.

* Indicating what per cent of all reports received stated the presence of diphtheria then under the observation of the physicians reporting. Over 46,000 weekly reports of sickness and constant registers of the wind nearly every hour of every day during ten years at 8 stations in Michigan are represented in this diagram.

† Because diphtheria is a contagious disease of children, the general opening of schools from about the first Monday in September to the first Monday in November probably unusually increases the sickness from diphtheria in October and November.

No. 10.—VELOCITY OF THE WIND AND SICKNESS FROM DIPHTHERIA IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



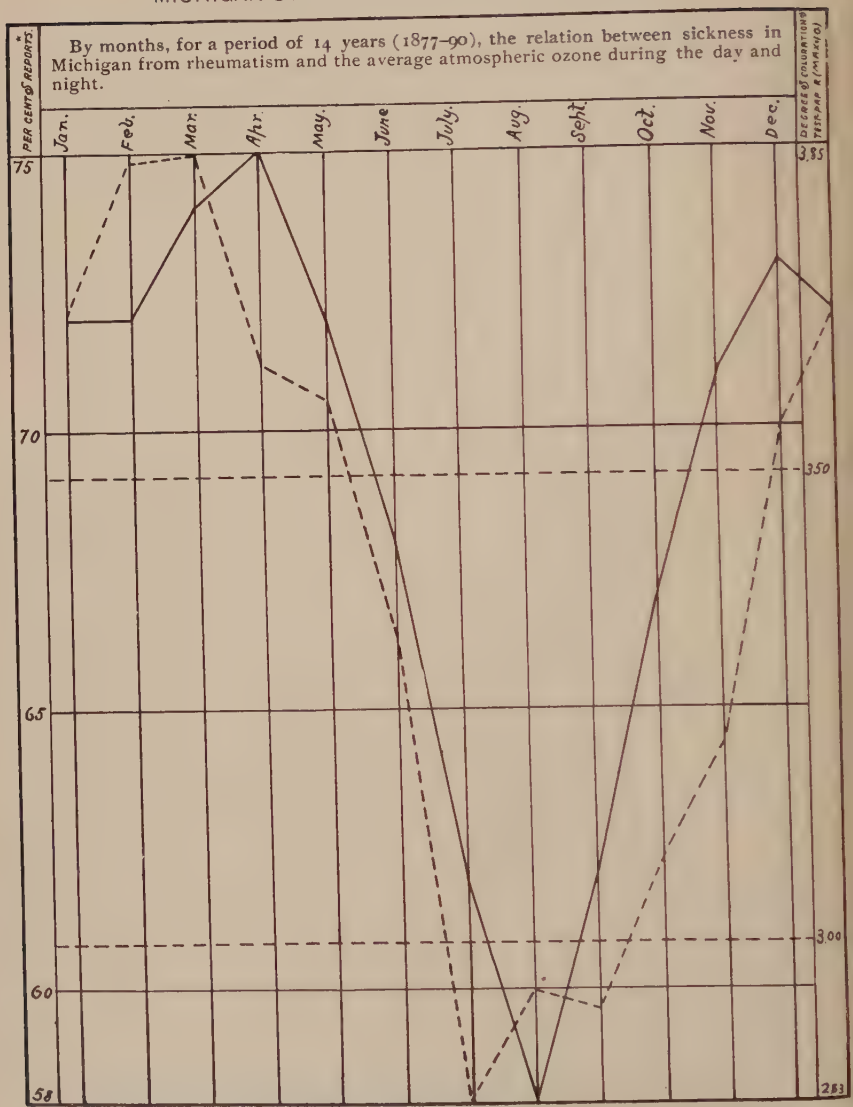
Atmospheric temperature - - - - - - - . Tonsillitis ———— . Rheumatism —·—·—·—·

* Indicating what per cent of all reports received stated the presence of tonsillitis and rheumatism then under the observation of the physicians reporting

Over 57,000 weekly reports of sickness and over 268,000 observations of the atmospheric temperature are represented in this diagram.

No. 11.—TONSILLITIS FOLLOWS TEMPERATURE; RHEUMATISM FOLLOWS TONSILLITIS.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



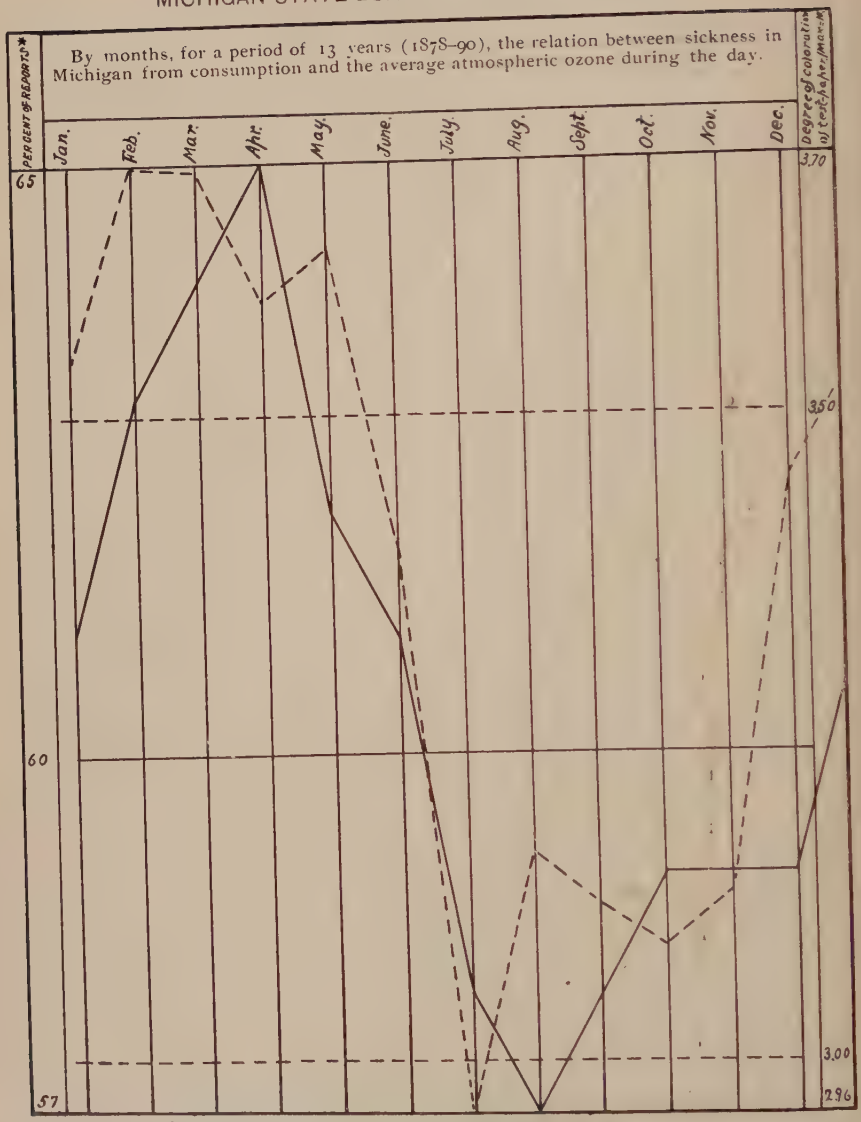
Sickness from rheumatism ———. Atmospheric ozone, day and night – – – –.

* Indicating what per cent of all reports received stated the presence of rheumatism then under the observation of the physicians reporting.

Over 59,000 weekly reports of sickness and over 138,000 observations of atmospheric ozone are represented in this diagram.

No. 12.—ATMOSPHERIC OZONE AND SICKNESS FROM RHEUMATISM IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



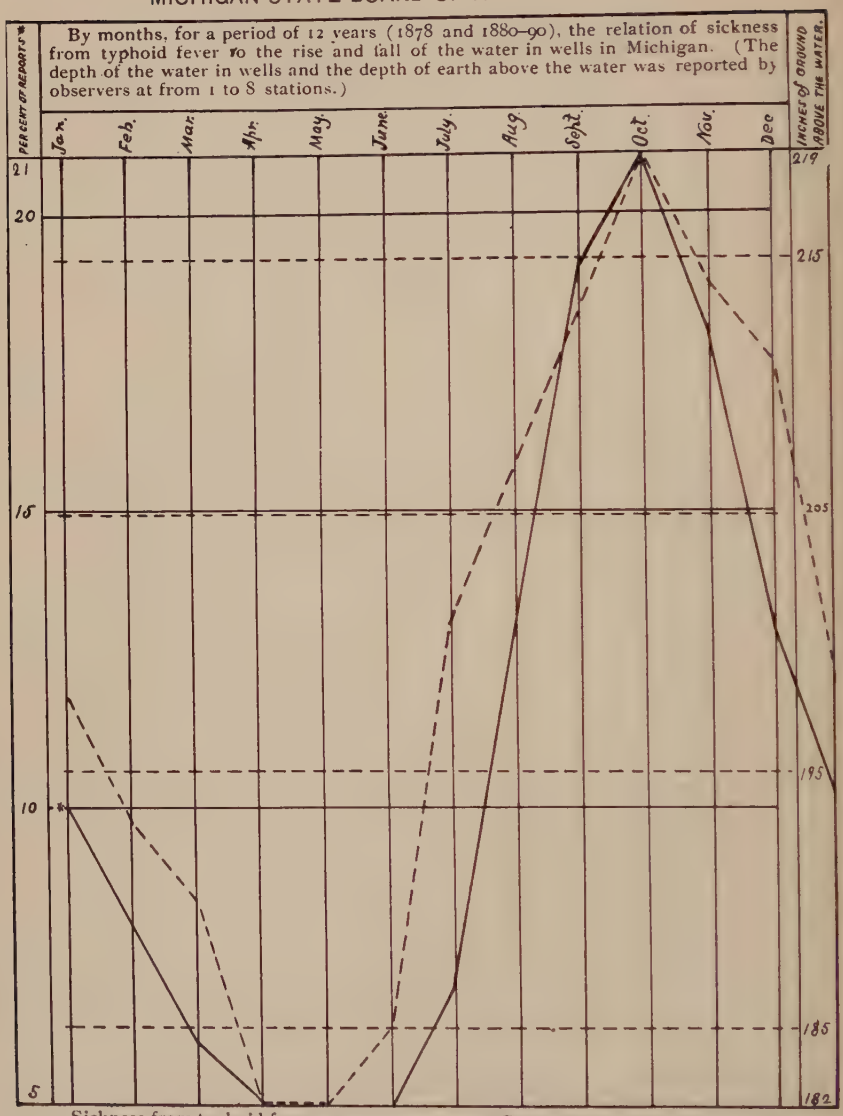
Sickness from consumption ———————. Atmospheric ozone, day - - - - - - - -.

* Indicating what per cent of all reports received stated the presence of consumption then under the observation of the physicians reporting.

Over 56,000 weekly reports of sickness and over 69,000 observations of atmospheric ozone are represented in this diagram.

No. 13.—ATMOSPHERIC OZONE AND SICKNESS FROM CONSUMPTION IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



Sickness from typhoid fever ———————. Ground water – – – – – – – – – – –.

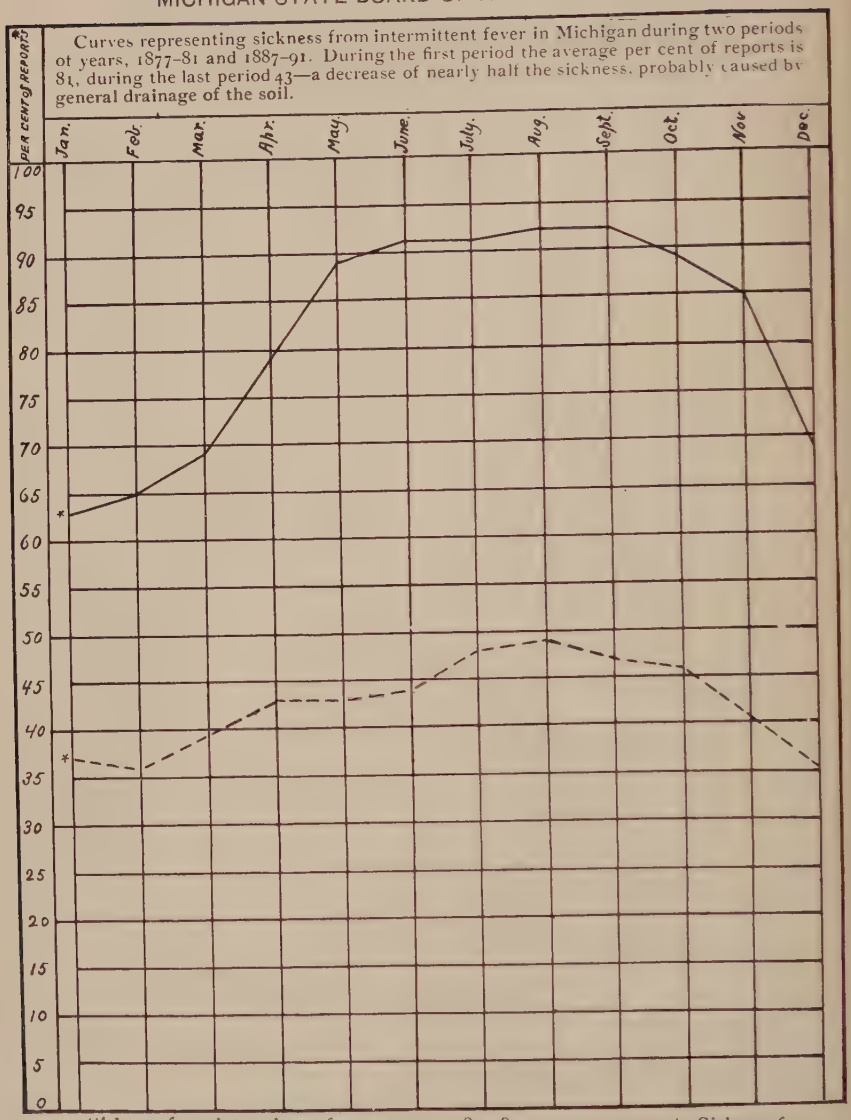
* Indicating what pe. ·ent of all reports received stated the presence of typhoid fever then under the observation of the physicians reporting.

Over 53,000 weekly reports of sickness and over 500 observations of the depth of water in wells are represented in this diagram.

NOTE.—The danger from typhoid fever appears to be greatest in October, when the water in wells is lowest; that is, when there are the most "Inches of earth above the ground water." The danger is least in May, when the water in wells is highest.

No. 14.—LOW WATER IN WELLS AND SICKNESS FROM TYPHOID FEVER IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



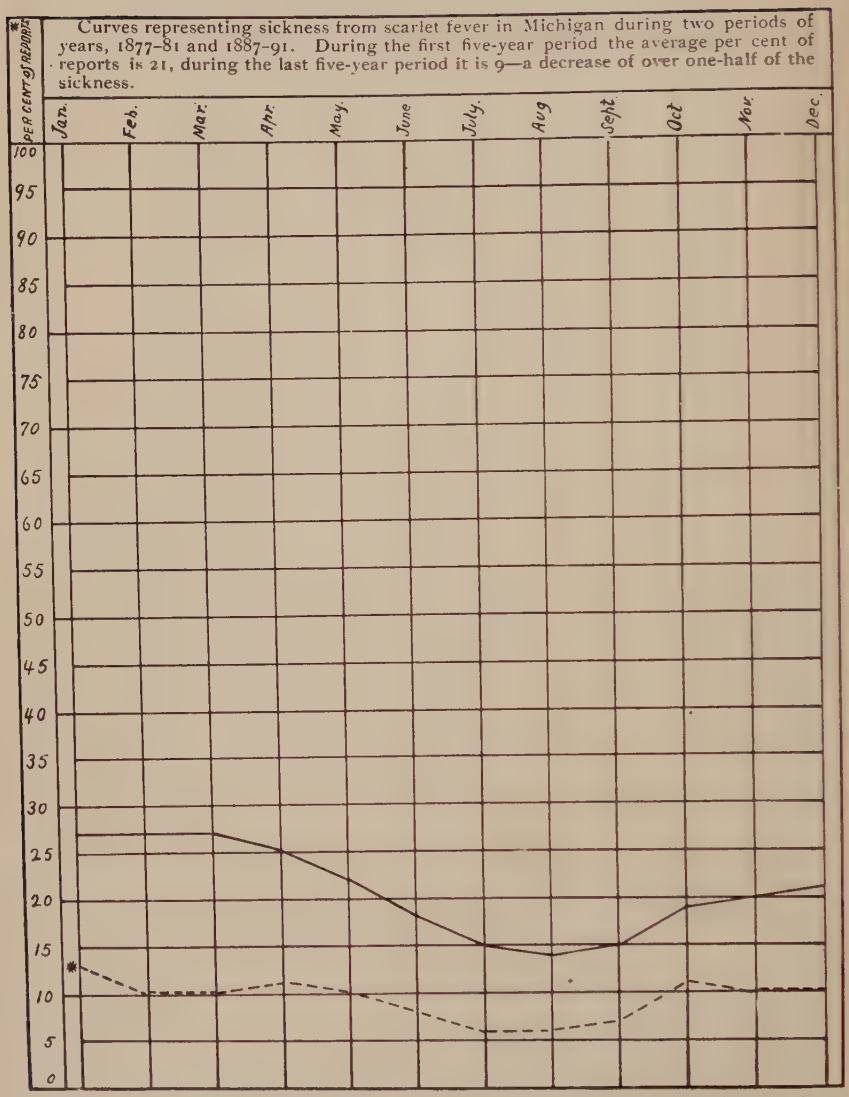
Sickness from intermittent fever, 5 years, 1877-81. ———————. Sickness from intermittent fever, 5 years 1887-91, — — — — — — — — .

* Indicating what per cent of all reports received stated the presence of intermittent fever then under the observation of the physicians reporting.

Over 17,000 weekly reports of sickness were received for the first period, and over 24,000 for the last period.

No. 15.—DECREASE OF SICKNESS FROM INTERMITTENT FEVER IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



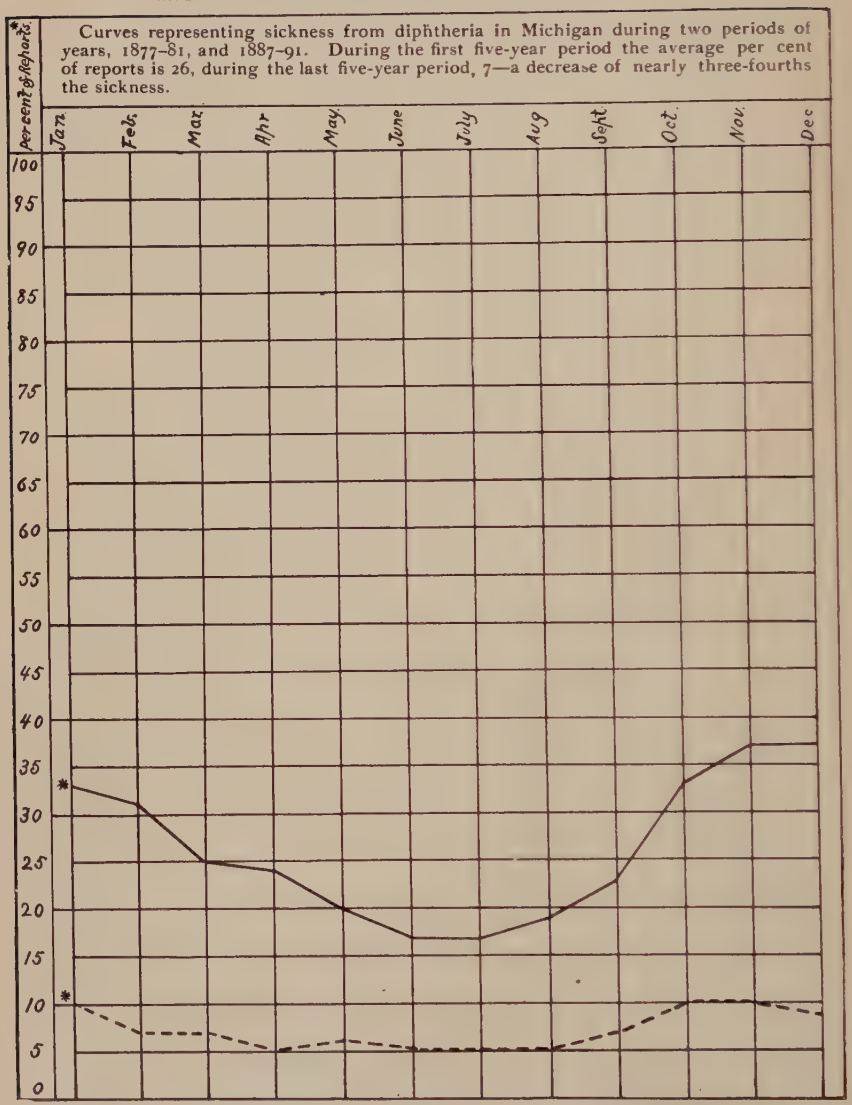
Sickness from scarlet fever, 5 years, 1877–81, ————————. Sickness from scarlet fever, 5 years, 1887–91, — — — — — — — —.

* Indicating what per cent of all reports received stated the presence of scarlet fever then under the observation of the physicians reporting.

Over 17,000 weekly reports of sickness were received for the first period and over 24,000 for the last period.

No. 16.—DECREASE OF SICKNESS FROM SCARLET FEVER IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



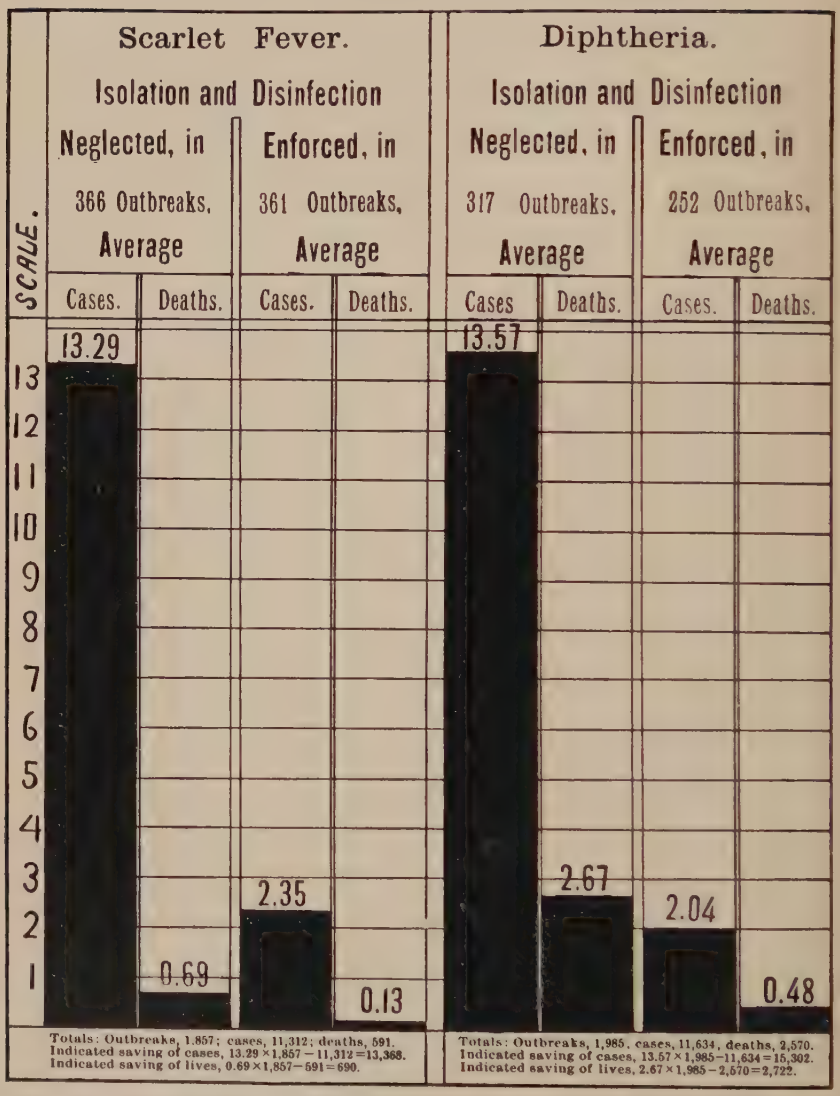
Sickness from diphtheria, 5 years, 1877–81, ————. Sickness from diphtheria, 5 years, 1887–91, – – – – – – – – – – –.

* Indicating what per cent of all reports received stated the presence of diphtheria then under the observation of the physicians reporting.

Over 17,000 weekly reports of sickness were received for the first period and over 24,000 for the last period.

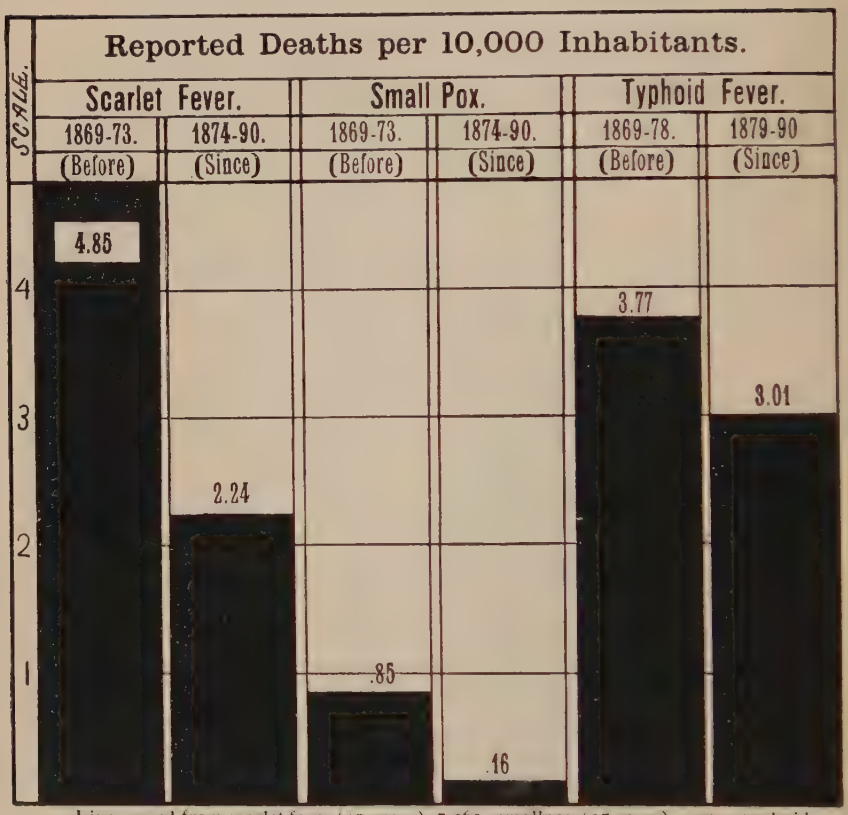
No. 17.—DECREASE OF SICKNESS FROM DIPHTHERIA IN MICHIGAN.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



ISOLATION AND DISINFECTION RESTRICTED SCARLET FEVER AND DIPHTHERIA IN MICHIGAN DURING THE FIVE YEARS 1886–90.

MICHIGAN STATE BOARD OF HEALTH EXHIBIT.



Lives saved from scarlet fever (17 years), 7,265; smallpox (17 years), 1,921; typhoid fever (12 years), 1,671.

LIVES SAVED BY PUBLIC-HEALTH WORK. COMPARISON OF DEATH RATES IN MICHIGAN FROM SCARLET FEVER AND SMALL-POX BEFORE AND SINCE THE STATE BOARD OF HEALTH WAS ESTABLISHED, AND FROM TYPHOID FEVER BEFORE AND SINCE ITS RESTRICTION WAS UNDERTAKEN BY THE STATE BOARD.

Compiled from State Department's "Vital Statistics" of Michigan.

most universal means of sanitation, and the most economical and potent to which public or private hygiene can have recourse. The turning up of the soil liberates pathogenic germs, but when the soil is not disturbed for a long time a colossal germination frequently goes on. Exhumation frees the bacteria long latent in the soil; hence the epidemics that follow the turning up of the ground. Pathogenic germs leave the earth in many ways to attack men and animals. The soil which adheres to the body, to the feet of animals, and that which is carried by insects disseminates pathogenic germs. Currents of air transport superficial dust and so propagate the spores which resist exsiccation. Water also carries germs. Ordinarily subterranean waters are on a level with the bacteriological zone. Sometimes the zone is exposed by fissures or by openings made in the earth. The walls of a well are a prolongation of the superficies, and are favorable to the life of germs.[1]

The practical application of this summary is local sanitation. The more precise knowledge, acquired during recent years, of the specific entities of preventable diseases; of the part played by earth, air, and water in their dissemination, and of their essential dependence upon putrescible matter for their reception and growth, should not fail to stimulate sanitary effort everywhere against the conditions of their existence.

DEMOGRAPHIC STATISTICS OF DISEASES FOR FIFTEEN CONSECUTIVE YEARS IN THE STATE OF MICHIGAN.

By HENRY B. BAKER, M. D., of Lansing, Mich.,

Secretary of the State Board of Health of Michigan; ex-President of the American Public Health Association; member of the American Climatological Association, etc.

DISEASES WHICH CAUSE MOST SICKNESS IN MICHIGAN.

Order of prevalence of twenty-eight diseases in Michigan in the period of ten years, 1881 to 1890, and in each of those years, judging from the "per cent of reports" which stated the presence of each of the diseases, in connection with the reported "order of prevalence" when and where each disease was present.

Order.	Diseases arranged in order of greatest prevalence.	Average order, 1881–'90.	1890.	1889.	1888.	1887.	1886.	1885.	1884.	1883.	1882.	1881.
1	Rheumatism	2	1	1	1	1	1	3	2	4	4	2
2	Neuralgia	2	2	2	2	2	2	1	1	2	2	4
3	Bronchitis	3	3	3	3	3	3	4	4	3	3	3
4	Intermittent fever	3	8	5	4	5	4	2	3	1	1	1
5	Consumption, pulmonary	5	6	6	5	4	5	5	5	5	5	7
6	Diarrhœa	6	5	4	6	6	7	7	6	6	7	6
7	Tonsillitis	7	7	7	7	7	6	6	7	7	9	8
8	Influenza	8	4	8	8	8	8	8	9	8	8	9
9	Remittent fever	8	9	9	9	9	9	9	8	9	6	5
	(The average disease)	10	9	10	11	11	10	10	10	11	11	11
10	Pneumonia	10	10	10	10	10	10	10	10	10	10	10
11	Erysipelas	13	15	12	11	11	11	11	12	12	15	17
12	Inflammation of the kidney	14	15	14	16	15	13	12	11	----	----	----
13	Cholera morbus	14	12	15	15	12	14	15	15	15	16	14
14	Dysentery	15	14	13	13	13	15	19	14	13	17	15
15	Typho-malarial fever	15	19	17	14	14	16	14	17	14	12	13
16	Whooping cough	15	13	11	20	19	12	13	13	19	13	19
17	Measles	17	11	22	12	16	22	25	23	11	20	11
18	Pleuritis	17	18	16	17	----	----	----	----	----	----	----
19	Cholera infantum	18	17	18	18	18	17	18	18	17	19	16
20	Diphtheria	19	23	24	23	20	19	16	20	18	11	12
21	Inflammation of bowels	19	21	19	19	17	18	17	21	20	21	21
22	Scarlet fever	22	21	22	22	20	20	19	19	16	14	20
23	Typhoid fever (enteric)	20	20	20	21	21	21	21	22	21	18	18
24	Puerperal fever	23	24	23	24	23	24	24	16	24	22	24
25	Inflammation of brain	24	27	27	27	24	23	22	24	22	23	25
26	Membranous croup	25	25	26	26	25	25	23	26	23	25	23
27	Cerebro-spinal meningitis	25	26	25	25	26	26	26	25	25	24	22
28	Smallpox	27	28	28	28	27	27	27	27	26	26	26

In the years 1881-1883 intermittent fever, in the years 1884-'85 neuralgia, and in the years 1886-1890 rheumatism, caused most sickness. This does not imply that there was any increase in rheumatism, because, as indicated by this table, and as is proved in the diagram on that subject,

[1] La Revista Internationale d'Igiene, of Naples, January, 1890.

intermittent fever decreased greatly. The "average disease" of those reported is included in this table as a standard by which to judge the fluctuations. In 1890 it may be seen that the "average disease" was higher than usual by about one-tenth. This was due to the unusual prevalence of "influenza," which, it may be seen, was twice as prevalent in 1890 as in the average year, the order in the average year being 8, while in 1890 it was 4. Pneumonia does not show any increase in 1890, nor any apparent change during the ten years.

MOVIMIENTO DEMOGRÁFICO DE BUENOS AIRES.

Por el Dr. SAMUEL GACHE,

Presidente del Círculo Médico Argentino; Medalla de Oro en el Concurso Sud-Americano de Medicina Celebrado en Buenos Aires en 1893; Delegado del Gobierno de la República Argentina en el Congreso Internacional de Higiene y Demografía, reunido en Paris, en 1889; Miembro de la Société Française d'Hygiène de Paris; Oficial de Academia; Médico del Hospital Ravosón.

La ciudad de Buenos Aires, capital de la República Argentina, cuenta hoy 560,000 habitantes, sobre una extensión de 13,023,572 metros cuadrados, que es la del territorio del municipio. Remontando á los primeros tiempos del país y buscando hasta en la época de la fundación, encontramos que su población en el año 1580 era de 300 almas, y que en 1602 llegó á 500, para aumentar á 4,000 en 1664. Un siglo más tarde era de 24,205; en 1810 alcanzó á 46,000; en 1822, á 55,416, y á 76,000 en 1852. En 1864 era de 140,000; el censo de 1869 le dió 177,787; surbió á 195,262 en 1871; la epidemia de fiebre amarilla ocurrida en este año no detuvo el desarrollo de este movimiento progresivo, y la cifra total de habitantes era de 204,634 en 1872, es decir, arrojaba un aumento de 9,372 sobre la anterior, constituyendo un crecimiento relativo de 4.7. En 1875 tenía la ciudad 230,000 almas.

	Población.		Población.
1879	257,440	1889	523,452
1880	270,000	1890	547,144
1881	289,925	1891	535,060
1887	433,375	1892 (diciembre)	554,713
1888	455,167	1893 (junio)	560,000

La disminución que se observa en el año 1891 se explica por las causas de orden financiero que produjeron intensa crísis, y que obligaron á muchos á emigrar en busca de mejores condiciones de trabajo y economía que las que entonces ofrecía Buenos Aires. En 1892 la población ha aumentado meramente, y lo mismo se observa en 1893. El más poderoso factor con que hemos contado ha sido la inmigración que ha venido al país, y de la cual alguna buena parte se ha establecido en la ciudad, incorporándose á ella como fuerza y como elemento de producción y consumo.

El siguiente cuadro relativo al descenso de 1882-'91 hará comprender mejor el movimiento de entradas y salidas:

Año.	Inmigración.	Emigración.	Año.	Inmigración.	Emigración.
1882	53,503	8,720	1887	117,711	13,630
1883	62,243	9,510	1888	155,632	16,842
1884	77,805	14,440	1889	260,909	40,649
1885	108,722	14,585	1890	132,301	82,981
1886	98,116	13,907	1891	29,831	67,559

En 1892 la inmigración fué de 93,550 individuos; la emigración de 55,282, lo que da un exeso de 38,468 en favor de la primera. Estos lijeros apuntes bastan para dar una idea general sobre la población de Buenos Aires, población cosmopolita constituida en su parte principal por el hijo del país y por los extranjeros numerosos, entre los cuales predominan los italianos, ocupando el segundo lugar los españoles, y los siguientes los franceses, ingleses, suizos, alemanes, etc. Exami-

nemos el movimiento demográfico de esta ciudad, y hagamos las comparaciones y deducciones á que se presten los datos que vamos á estudiar.

La natalidad en Buenos Aires nos ofrece la oportunidad de hacer algunas consideraciones sobre la fecundidad de la mujer argentina. Los matrimonios en nuestro país producen por lo general cinco hijos; y ha sido en virtud de esta abundante reproducción y de la grande inmigración que siempre ha acudido aquí, como ha podido la república ofrecer el aumento de su población que, siendo de 1,877,490 habitantes en 1869, ha llegado en 1893 á 4,500,000. Y por lo que se refiere á Buenos Aires, sabemos ya que en 1869 tenía 177.787 almas, y que hoy su número asciende á 560,000. Los nacimientos en los pueblos argentinos han alcanzado cifras elevadísimas; y para no citar sino dos casos nos referiremos á las ciudades de Buenos Aires y La Plata, que con sus respectivas proporciones ocupan los dos primeros rangos en la natalidad de todo el mundo, exceptuando el Cairo. Pero debemos observar que si en el Cairo, según la estadística de 1891, la natalidad es mayor que en las dos ciudades referidas, siendo así el punto más favorecido al respecto, en cambio también tenemos allí una grandísima mortalidad, y resulta que si ocurren 51 nacimientos sobre 1,000 almas, mueren 50.6 individuos sobre 1,000, lo que da un aumento vegetativo sumamento pobre: 0.4 por 1,000, mientras que dicho aumento vegetativo en La Plata es de 23.85 (año 1890) y en Buenos Aires de 21.6. Este último dato resulta de los siguientes elementos:

Natalidad en 1891	24,591
Natalidad por 1,000 habitantes	45.95
Mortalidad absoluta	13,041
Mortalidad por 1,000 habitantes	24.32
Aumento vegetativo absoluto	11,577
Aumento vegetativo por 1,000 habitantes	21.6

Estas cifras revelan muy crecida cantidad de nacimientos, y exceptuando la de 118 por 1,000 habida en Buenos Aires en 1872, después de la epidemía de fiebre amarilla, jamás se ha visto proporción tan satisfactoria. La Plata, capital del Estado de Buenos Aires, ha dado en los ultimos años:

Años.	Natalidad por 1,000 habitantes.	Mortalidad por 1,000 habitantes.	Aumento vegetativo por 1,000 habitantes.
1884	42.90	17.74	25.16
1885	37.16	19.09	18.07
1886	48.20	21.93	26.27
1889	43.83	25.46	18.37
1890	49.62	25.77	23.85

La extraordinaria natilidad de La Plata en 1890 coloca pues á esta hermosa ciudad en el primer rango por el aumento vegetativo de su población. Le sigue Buenos Aires con su aumento de 21.6 por mil, proporción que permite á ámbas figurar entre las principales del globo, en este sentido. En el decenio de 1882–91 han nacido en Buenos Aires:

Años.	Varones.	Mujeres.	Total.	Ilegítimos.	Proporción.
					Por ciento.
1882	5,276	5,201	10,477	839	8
1883	5,514	5,278	10,792	829	7.6
1884	6,030	5,840	11,870	817	6.8
1885	6,436	6,145	12,581	816	6.4
1886	7,227	6,776	14,003	1,141	8.1
1887	8,225	7,714	15,939	1,974	12.3
1888	9,764	9,355	19,119	2,361	12.3
1889	11,258	10,786	22,044	2,798	12.6
1890	11,737	11,283	23,020	3,013	13
1891	12,512	12,079	24,591	3,342	13.5
Total	83,979	80,457	164,436	17,930	

Dividiendo estas cifras en dos períodos de cinco años, tenemos: De 1882 á 1886, nacimientos, 59,733, siendo de estos 4,442 ilegítimos; de 1887 á 1891, nacimientos, 104,703, de los cuales 13.488 son ilegítimos. Se ve por estas cifras que la ilegitimidad en el quinquenio de 1887 á 91 fué más de tres veces superior á la de 1882-86. Creemos encontrar las causas de esto en el hecho de las circunstancias excepcionales del país, con motivo de la gran crísis que lo ha conmovido y que hoy más que nunca se siente. La ilegítimidad está actualmente sostenida en Buenos Aires por la falta de dinero que actúa sobre todas las clases sociales y en especial las más bajas que son las que suministran el mayor contingente de este elemento.

La natalidad con relación á la población, y según sexos, de los nacidos, está expresada en el siguiente cuadro:

Años.	Población.	Nacimientos.	Proporción por 1,000 habitantes.	Varones para 100 mujers.
1887	437,875	15,939	36.40	106
1888	455,167	19,119	42	104
1889	523,452	22,044	42.10	104
1890	547,144	23,020	42.07	104
1891	536,060	24,591	45.95	103

Conocido ya lo que sobre natalidad nos ofrece Buenos Aires y La Plata, hagamos algunas comparaciones entre estas y otras de las más importantes ciudades de Europa y América.

	Natalidad por 1,000 habitantes.	Mortalidad por 1,000 habitantes.	Aumento vegetativo por 1,000 habitantes.		Natalidad por 1,000 habitantes.	Mortalidad por 1,000 habitantes.	Aumento vegetativo por 1,000 habitantes.
Buenos Aires (capital)	45.95	24.32	21.6	Dantzic	35	25	10
La Plata	49.62	25.77	23.85	Leipzig	40	20	20
Montevideo	38.03	22.06	15.7	Hamburgo	35	20	15
Nueva York	27	25	2	Nuremberg	37	24	13
Paris	25	22.3	2.7	Munich	37	26	9
Marsella	30.8	30.6	.2	Hannover	35	21	14
Lóndres	32	21	11	Budapesth	35	27	8
Cardiff	36	22	14	Madrid	*26.2	26.3	.1
Dublin	28	27	1	Valencia	38	29	9
Sheffield	36	24	12	Lisboa	35	34.87	.13
Edinburgh	28	22	6	Roma	27	23	4
Birmingham	34	22	12	Milan	31	30	1
Liverpool	34	27	7	Turin	26	21	5
Aberdeen	32	20	12	San Petersburgo	30	28.4	1.6
Leeds	34	22	11	Moscow	38	37	1
Berlin	32	21	11	Varsovia	38	22	16
Frankfort	28	18	10	Copenhagen	32	21	11
Mulhouse	34	15	19	Stockolmo	34	23	11
Alejandría	42	38	4	Berna	30	20	10
El Cairo	51	50.6	.4	Ginebra	21.1	20.7	.4
Bremen	29	20	9	Zurich	29	19	10
				Bâle	29	17	12

* Madrid ha tenido en 1891 mayor mortalidad que natalidad.

Resumiendo, tenemos que deben colocarse en este órden las ciudadas de mayor aumento vegetativo de su población: La Plata, Buenos Aires, Leipzig, Mulhouse, Magdeburgo, Varsovia, Montevideo, Hannover, Cardiff, Dresden, Nuremberg, Aberdeen, Birmingham, Bâle, Leeds, Lóndres, Berlin, Stockolmo, Dantzig, Franckfort, Zurich, Copenhague. Resulta pue que Buenos Aires es la región más favorecida en todo el globo, bajo el punto de vista de su natalidad y del crecimento vegetativo de su población. Y consignaremos aquí como informe complementario, que en 1871, después de la epidemia de fiebre amarilla que en 1871 hizo 13.761 muertes, los nacimientos alcanzaron á la enorme proporción de 118 por 1,000 habitantes.

En cambio, las ciudades cuya mortalidad superó á la natalidad en el año 1891 son:

	Natalidad.	Mortalidad.		Natalidad.	Mortalidad.
Madrid	17,507	17,563	Rouen	2,771	3,762
Madras	18,125	23,873	Toulouse	2,661	3,113
Burdeos	5,273	6,364	Bologna	3,637	3,677
Lyon	8,461	9,371	Florencia	5,028	5,211
Nancy	2,056	2,048	Christiania	2,588	3,013
Nantes	2,653	3,313	Bombay	15,543	23,784

Lima en 1884 presentó una natalidad de 3,845 y una mortalidad de 4,046; debe colocarse, pues, en la anterior categoría. Chile, por el contrario, ofrece una natalidad de 40 por 1,000 y una mortalidad de 32 por 1,000, lo que dá como aumento vegetativo 8 por 1,000. Terminando estas consideraciones diremos que en Chile sobre 1,000 nacimientos, 295 son ilegitimos; y que en Lima, sobre 3,820 nacimientos ocurridos el año 1884, fueron legítimos 1,759, y 2,061 ilegítimos, lo que da el promedio de 54 de estos por 46 de aquellos.

La nupcialidad ha pasado por muy diversas alternativas entre nosotros, y aunque actualmente no figura ella en la estadística demográfica con las cifras que sería conveniente para los fines ulteriores de la sociedad, es justo reconocer que ha experimentado un aumento considerable. De las investigaciones de Coni resulta que el número total de matrimonios verificados en Buenos Aires creció desde el año 1858 hasta el año 1873, y disminuyó gradualmente desde este último hasta 1877; y que á partir de esta fecha hasta 1881 se observa un estado estacionario. Tratando de explicar este fenómeno, podemas preguntar ¿por qué esta disminución en la cifra de los matrimonios y por qué este estacionamiento? Si queremos encontrar las respuestas, recordemos que la crisis política, iniciada en 1872 con motivo de los trabajos electorales, se prolongó después de 1874, no ya bajo ese carácter solamente sino también y de principal manera como crisis económica que obligó á todos los argentinos á reducir el monto de sus gastos.

En 1878 la proporción de matrimonios comparada con la población fué de 6.3 por 1,000; en 1879 de 6, y en 1880 de 6.1; proporción muy superior á la que corresponde al período de 1869–'77 en que fué 8.1 por 1,000. Pero á contar desde 1881, un fenómeno social se produce, íntimamente relacionado con el estado de abundancia del país, abundancia ficticia, debida á empréstitos exteriores y á desarreglos financieros cuyas consecuencias hasta los hijos de nuestros hijos tendrán que soportar. Los medios de obtener el dinero eran fáciles; los bancos ofrecían comodidades, y todos obtenían créditos. Con estos elementos, se comprende que los matrimonios fueran más frecuentes que nunca, y así se ha visto que en 1890 la nupcialidad fué de 10.13 por 1,000 habitantes.

El cuadro que va en seguida pone de manifiesto la marcha de la nupcialidad en los años que se indican.

Años.	Población.	Matrimonios.	Proporción por 1,000 habitantes.	Años.	Población.	Matrimonios.	Proporción por 1,000 habitantes.
1887	437,875	3,428	7.82	1890	547,144	5,545	10.13
1888	455,167	4,498	9.88	1891	535,060	5,007	9.35
1889	523,452	4,159	7.94	1892	554,718	4,607	----------

Bajo esto aspecto, Buenos Aires viene á estar más favorecida que San Petersburgo, cuya nupcialidad es de 6.4 por 1,000 habitantes, en tanto que en Roma es de 6; en Nápoles de 7.3; en Amberes de 8.6; siéndole superiores Paris con 11; Boston con 13.9. La proporción de matrimonios en Berlin es igual á la nuestra.

Vemos que en 1892 han disminuido los matrimonios, y debemos encontrar en esto una consecuencia lógica de la crísis que dificulta los gastos y aumenta la emigración.

La mortalidad en Buenos Aires en el quinquenio de 1887–1891 ha sido esta:

Años.	Mortalidad.	Proporción por 1,000 habitantes.
1887	12,894	27.59
1888	13,482	27.16
1889	16,039	28.15
1890	17,721	29.99
1891	14,332	24

Se ve pues que la proporción por 1,000 habitantes ha disminuido durante el año 1891, y la diferencia es considerable, si se comparan las cifras anteriores. Es así que Buenos Aires queda en mejores condiciones que las ciudades que se expresan con la relación de su mortalidad por 1,000:

Havre	30.6	Breslau	29.1	Alejandria	38.1
Marsella	30.5	Dresden	29	Madras	52.7
Nancy	26.3	Munich	27.6	Milan	30
Nantes	26.2	Trieste	30.4	Cairo	50.7
Reims	26.1	Barcelona	30.7	San Petersburgo	28.5
Rouen	35.3	Madrid	36.4	Bombay	28.9
Dublin	26.1	Lisboa	34.8	Valencia	29.3
Manchester	26	Moscou	37.3	Florencia	28.5

Buenos Aires, con su mortalidad de 24 por mil correspondiente al año 1891, viene á estar igual á Paris, Nueva York, Brooklyn, Nuremberg, Lyon, Tolosa, Saint Etienne, etc. Las enfermedades que han contribuido á la mortalidad ocurrida en la capital argentina, con una cifra mayor de 100, son:

Diagnósticos.	1887.	1888.	1889.	1890.	1891.	Totales.
Tuberculosis	1,041	1,069	1,245	1,168	814	4,337
Neumonia	802	811	1,016	1,075	910	4,614
Viruelas	1,299	657	185	2,198	276	4,615
Difteria	753	1,113	646	802	510	3,794
Gastro-enteritis	412	488	1,017	865	884	3,666
Meningitis	599	666	721	770	820	3,576
Lesiones cardiacas	568	621	685	561	515	2,950
Enteritis	318	422	614	447	568	2,[illegible]
Bronco-neumonia*	303	303	642	583	520	2,351
Fiebre tifoidea	280	388	509	628	408	2,213
Atrepsia	327	352	540	390	457	2,066
Bronquitis	281	342	479	472	436	2,010

* Esta enfermedad se presentó como la neumonia en muchos casos después de la influenza, que fué epidémica en 1890, 1891 y 1892.

	1887.	1888.	1889.	1890.	1891.	Totals.
Debilidad congénita	291	298	413	420	367	1,789
Apoplegía cerebral	214	289	390	401	392	1,696
Tétano infantil	212	266	403	352	319	1,552
Crup	242	272	259	235	143	1,151
Congestión cerebral	168	192	203	240	199	1,002
Consunción	118	179	243	195	134	869
Peritonitis	89	128	141	169	142	669
Sarampión	141	99	261	80	54	635
Entero-colitis	80	84	188	125	156	633
Nefritis	64	67	101	110	134	591
Eclampsia infantil	103	101	126	117	144	591
Senectud	102	102	127	100	102	533
Cólera*	530					530
Heridas diversas	106	116	78	100	99	499
Aneurisma de la aorta	42	59	92	122	133	448
Sífilis infantil	98	91	106	68	63	426
Heridas por arma de fuego	29	39	33	266	50	400
Asfixia por sumersión	51	71	90	102	78	392
Enfermedades puerperales	50	71	85	75	68	349
Cancer	77	77	86	88	65	393
Hepatitis	68	70	73	67	67	345
Alcoholismo	64	60	92	68	54	338
Coqueluche	35	67	85	57	93	337
Oclusión intestinal	36	43	62	79	78	298
Uremia	91	45	64	63	75	296
Disenteria	51	72	69	42	58	292
Congestión pulmonar	39	65	66	57	53	280
Esclerosis del hígado	81	77	24	52	54	268
Pleuro-neumonia	39	45	43	69	59	255
Pleuresía	35	40	54	68	58	255
Fracturas	39	52	70	64	17	243
Inanición	70	43	49	31	43	236
Meningo-encefalitis	42	34	49	56	53	234
Ustión	44	65	36	49	39	233
Gangrena	34	38	39	67	38	216
Anémia	52	35	52	31	36	206
Laringitis	27	44	25	56	51	203
Hemorragia	20	29	41	61	31	182
Endocarditis	17	32	27	57	46	179
Infección purulenta	26	53	21	50	25	175
Encefalitis	39	31	25	38	24	157
Mielitis	25	28	43	31	26	153
Cirrosis hepática			48	58	47	153
Aneurismas diversas	18	33	43	31	20	145
Escarlatina	62	17	17	26	11	133
Angina de pecho	16	27	36	26	24	129
Anemia cerebral	19	17	17	47	29	129
Hidrocefalia	21	18	37	24	19	119
Erisipela	18	32	23	22	23	118
Traumatismos diversos			46	47	18	111
Reumatismo	20	30	29	18	12	109
Marasmo			9	36	60	105

*En 1886 se produjeron 530 muertes por el cólera.

Durante los años transcurridos de 1886 al 1891 inclusive, la mortalidad por enfermedades infecto-contagiosas ha sido:

	1886.	1887.	1888.	1889.	1890.	1891.
Tuberculosis	863	1,048	1,088	1,263	1,182	826
Fiebre tifoidea	272	280	388	509	628	408
Difteria	453	1,052	1,385	905	1,037	623
Viruelas	536	1,299	657	185	2,198	275
Escarlatina	60	62	17	17	26	11
Sarampión	56	141	99	261	80	54
Coqueluche	29	35	67	85	57	93

Veamos ahora el cuanto por ciento de la mortalidad general que representan estas cifras divididas por años:

	1886.	1887.	1888.	1889.	1890.
	Por ciento.	*Por ciento.*	*Por ciento.*	*Por ciento.*	*Por ciento.*
Tuberculosis	8.63	8.66	8.79	8.57	7.19
Fiebre tifoidea	2.72	2.38	3.22	3.55	3.93
Difteria y crup	4.53	8.94	11.49	6.32	6.49
Viruelas	5.36	10.70	5.29	1.26	13.38
Escarlatina	10.70	.52	.13	.11	.16
Sarampión	.....	1.19	.82	1.82	.50
Coqueluche	.....	.29	.56	.59	.36

La mortalidad general del año 1892 llegó á 14.612, y distribuida según los principales y más frecuentes diagnósticos, resulta:

Tuberculosis	1,022	Menigitis	746
Bronquitis	497	Tétanos infantil	265
Bronco-pneumonia	936	Gastro-enteritis	712
Neumonia	1,144	Atrepsia	402
Pleuro-neumonia	80	Enteritis	462
Pleuresía	57	Debilidad congénita	316
Enfermedades cardio-vasculares	952	Nacido-muertos	1,271
Anemia, congestión y hemorragia cerebral	460	Cancer	369
		Fiebre tifoidea	214

Predominan las enfermedades infecciosas; y si es satisfactorio hoy comprobar que algunos han disminuido en frecuencia, es desconsolador decir que otras aumentan. Por lo que respecta á la tuberculosis, los siguientes cuadros revelan su marcha en los últimos 22 años:

Años.	Mortalidad por tuberculosis.	Mortalidad general.	Proporción.	Años.	Mortalidad por tuberculosis	Mortalidad general.	Proporción.
			Por ciento.				*Por ciento.*
1870	274	5,856	4.6	1882	808	7,196	11
1871	495	*20,748	2.4	1883	932	8,501	10.9
1872	597	5,671	10.5	1884	1,052	8,242	12.7
1873	755	5,891	12.8	1885	1,017	9,295	10.9
1874	685	7,190	9.52	1886	863	9,994	8.63
1875	858	6,751	12.7	1887	1,048	12,084	8.66
1876	783	5,277	14.8	1888	1,088	12,367	8.79
1877	716	5,538	12.9	1889	1,263	14,736	8.57
1878	756	5,536	13.6	1890	1,182	16,417	7.19
1879	776	6,794	11.4	1891	826	13,014	6.35
1880	774	7,073	10.9	1892	1,022	14,612	.....
1881	782	6,316	12.3				

* Epidemia de fiebre amarilla que produjo 13,761 muertes.

Cifras de 14.8, 13.6 y 12.9 por ciento de mortalidad tuberculosa sobre la general, eran por cierto, muy crecidas y seriamente alarmantes. El aumento progresivo de la tuberculosis en un tiempo en que las enfermedades zimóticas tienden á disminuir en número con la sola excepción de la viruela que obedece á causas específicas, dice Rawson, solo puede ser explicado por un aumento de humedad en el subsuelo, en combinación con las demás causas de insalubridad.

Felizmente la proporción se ha reducido en los últimos años á menos de la mitad de lo que era en la época á que se refiere el ilustre higienista, época en que la población solo era de 220,000 habitantes. Así vemos que la tuberculosis que causaba el año 1876 el 14.8 por ciento de mortalidad, solo llegó á 8.63 y 8.66 en 1886 y 87, y quedó en 6.35 por ciento en 1890, con más de medio millón de almas dentro de la ciudad. El decrecimiento de sus cifras mortuorias es debido á las mejoras urbanas, á las obras de salubridad, al funcionamiento regular de muchas secciones de cloacas, á la desaparición del horror que inspiraba en otro tiempo la idea de entrar en los hospitales; á la buena asistencia que estos establecimientos ofrecen no solo á los pacientes que alojan, sino también á los que van á los consultorios que en ellos funcionan; á la acción siempre vigilante de los numerosos asilos donde se

recojen niños que, sin los cuidados que allí se prodigan, serían candidatos á la enfermedad; y hasta puede atribuirse á la mayor instrucción que hoy tiene el público respecto de muchas cosas.

Pero de todas las circunstancias favorables que han producido estos resultados, es ciertamente la primera el drenage. El Dr. Buchanan, observando los efectos de las obras de drenage en veinte y cinco ciudades de Inglaterra, informaba que en todas ellas la mortalidad general ha disminuido, en particular la causada por la fiebre tifoidea y la diarrea; pero en aquellas que habían sido provistas de grandes desagües, sin dárseles un sistema eficaz de drenage subsolar, ni la consunción pulmonar, ni las afecciones catarrales habían disminuido. El efecto inmediato del drenage subterráneo es secar el suelo permitiendo que el aire penetre y ocupe el lugar del agua al travez de la capa de tierra seca, acelerando así la oxigenación de las sustancias infectas que estaban en solución y poniendo el suelo en condiciones saludables. Además, este procedimiento secante ejerce una poderosa influencia sobre las capas atmosféricas inmediatamente contiguas al suelo y que forman el aire respirado por los habitantes. Se ha observado como regla invariable de fácil explicación por las leyes físicas, que las nieblas desaparecen ó disminuyen de un modo notable en las ciudades ú otras partes doquiera que la tierra ha sido secada por el drenage. De los dos hechos precedentes debe deducirse que el aumento de los tuberculosos corresponde al aumento de la humedad subsolar, unida á otras influencias depresivas, y que si deseamos poner límite á esta grave enfermedad, en la que lo que más debe temerse es el carácter hereditario, es necesario que forme parte de las obras que se prosiguen ahora, un sistema más completo de drenage subsolar, no solo para prevenir la invasión de nuevas masas de agua, sino para secar las que ahora contiene la tierra, y remover así la infección actual.[1] Otra consideración que hay que tener en cuenta, en favor de la positiva rebaja de la cifra de defunciones por tuberculosis, es la epidemia de influenza que en 1890–91 y '92 atacó á la problación de Buenos Aires haciendo innumerables víctimas y despertando la irrupcion de aquella.

Así, pues, de la cifra correspondiente á esos años, deberían deducirse muchos casos que han sido determinados por la acción de la grippe, haciendo estallar á aquella. Comparando la mortalidad de tuberculosis en Buenos Aires y en las más importantes ciudades del globo, se tiene el convencimiento de que es nuestra capital la que ofrece al respecto más favorable estadística; y para esto no hay más que recordar que mientras que á esta enfermedad corresponde el 6.33 por ciento de defunciones en Buenos Aires, según datos del año 1890, representa en el mismo año el 13.41 por ciento en Bruselas; el 13.30 por ciento en Berlin; el 12,25 por ciento en Baltimore; el 9.85 por ciento en Londres; el 22.10 por ciento en Madrid; el 19.51 por ciento en Paris; el 9.26 por ciento en Roma; el 17.51 per ciento en San Petersburgo; el 22.19 por ciento en Viena; el 14.82 por ciento en Copenhague.

La difteria ha sido muchas veces el azote de esta ciudad.

Basta dirigir la mirada sobre el siguiente cuadro para comprender la marcha que ella ha seguido entre nosotros:

Años.	Mortalidad diftérica.	Años.	Mortalidad diftérica.	Años.	Mortalidad diftérica.
1871	36	1878	260	1885	336
1872	75	1879	384	1886	493
1873	100	1880	376	1887	975
1874	152	1881	240	1888	1,381
1875	152	1882	221	1889	915
1876	168	1883	193	1890	1,058
1877	195	1884	252	1891	631

[1] Buchanan, citado por Rawson.

El aumento de la mortalidad por difteria es considerable á partir del año 1884 en que fué de 253. En 1886 la vemos casi duplicar y llega á 493, para subir hasta 975 en 1887, y alcanzar en 1888 á 1381 que es la mayor hasta hoy. En 1889 disminuye una cuarta parte y vuelve á subir en 1890, para descender otra vez en 1891 y más aún en 1892.

Las cifras que venimos de examinar manifiestan malas condiciones en nuestra salubridad, y es sensible que á este respecto ofrezcamos estadística tan desfavorable. Ella se modificará, es seguro, con las medidas de desinfección á domicilio que hoy se adoptan, y con los consejos y prevenciones que se dirigen al público, pero mientras subsistan los conventillos, los tambos, las caballerizas, etc., en parages centrales, tendremos encima siempre el peligro común.

Con todo, podemos esperar que como disminuyó en 1891 y en 1892 por la acción de los medios higiénicos empleados, así continuará reduciendo sus estragos hasta colocarnos en posición más ventajosa. Los barrios donde mayor número de víctimas hace son los de los parroquias de San Cristobal, Balvanera, Santa Lucía y Pilar, los más favorecidos por una abundante población menesterosa y falta de comodidades. Por las inmediaciones de la plaza "Once de Setiembre," Constitución y Cementerio del Sur, ella ha sido frecuente, y es en esos parajes donde se encuentran muchas de las condiciones propicias al desarrollo de la enfermedad.

El otoño y el invierno son las estaciones en que recrudece con marcada intensidad. Si hacemos comparaciones entre la mortalidad diftérica de Buenos Aires y otras ciudades de las que más alta la presentase, tenemos sobre 100 defunciones generales en los años 1886–90:

	1886.	1887.	1888.	1889.	1890.		1886.	1887.	1888.	1889.	1890.
Buenos Aires	4.53	8.94	11.49	6.32	6 49	Copenhague	4 16	5.11	5.2	6	7.45
Berlin	4 90	4.67	3.7	3.72	4 78	Marsella	4.4	4.77	4 3	3.36	5 20
Brooklyn	7 1	8.96	5.4	7.41	6.56	Madrid	.....	.....	6 7	3.76	3 44
Filadelfia	5·3	4 01	1.7	3.54	4.18	Chicago	.....	9.12	7.7	8.90	5.77

Son estas ciudades cuyas estadísticas conocidas revelan más alta mortalidad diftérica, y vemos que entre ellas Buenos Aires sobresale desgraciadamente por una alta proporción sobre el número total de aquella con relación á las defunciones generales.

Las viruelas han producido verdaderas epidemias en Buenos Aires hasta hace pocos años, y en especial con motivo de la conquista del desierto, que dió por resultado la incorporación de muchos miles de indios, en las casas como servidores, en los cuarteles como soldados, etc.; y es bien conocida la predisposición y facilidad que estos ofrecen á la invasión variólica.

Después de varios años en que estuvo relativamente apagada mediante la profilaxia de la vacuna, las viruelas recrudecieron en 1887 y su mortalidad se dobló con relación á la del anterior; se redujo á la mitad en 1888; descendió á 185 al siguiente y en 1890 tomó nuevo incremento, produciéndose 2,198 defunciones. Hagamos notar que en este año y con motivo de la revolución de julio, vinieron á la ciudad batallones de diferentes puntos, lo que es fácil suponer contribuyó á la difusión de la enfermedad por el hacinamiento y otras circunstancias. En 1891 la mortalidad por viruelas solo fué de 275 y en 1892 de 30. La ámplia difusión de la vacuna ha producido estos benéficos resultados al extremo de reducir la mortalidad de viruelas á cifras exiguas.

El siguiente cuadro es bien elocuente:

Vacunación y viruelas.

Años.	Vacunados y revacunados.	Mortalidad por viruelas.	Años.	Vacunados y revacunados.	Mortalidad por viruelas.
1883	6,906	1,510	1888	941	657
1884	3,006	142	1889	18,349	185
1885	5,600	736	1890	38,247	2,198
1886	4,205	536	1891	13,056	275
1887	2,726	1,267	1892	19,274	30

La fiebre tifoidea ha sido en todo tiempo conocida en Buenos Aires, y ha producido epidemias especialmente limitadas á barrios donde las gentes beben agua de pozo y viven en malas condiciones de higiene. Conviene decir que en tales casas las letrinas están inmediatas á los pozos, y que las filtraciones son fáciles. Si á los enfermos tifoideos en los hospitales se les pregunta acerca de la procedencia del agua de bebida, responden, de pozo. Y aunque puedan emplear las aguas corrientes, dejan estas por aquella. El servicio de aguas corrientes está bien establecido en Buenos Aires; corresponde próximamente 190 litros por habitante en las 24 horas; su composición es buena; no ofrecen peligro de infección "porque, dada su pobreza en materia orgánica, las bacterias patógenas no pueden vivir en ellas;" además, "son las más puras y mejores de la población," y "la cantidad de bacterias que contienen nada tiene de anormal." (Arata.)

Entre las epidemias de fiebre tifoidea, la del año 1867 se recuerda como muy mortífera. Produjo 600 muertes sobre una población de 177,787 habitantes. Al mismo tiempo que esta invadió el cólera. Desde 1869 hasta 1887, la tifoidea ha actuado entre nosotros produciendo más ó menos víctimas, pero á contar de este último año su mortalidad ha sido considerable con relación á una época en que precisamente debería suceder lo contrario, dado el adelanto de la higiene pública y la extensión de la bacteriología. En 1891 disminuye algo, y esta disminución se acentúa mucho en 1892 como resultado de las medidas adoptadas para mejorar las condiciones sanitarias, combatiendo las causas de insalubridad y arbitrando los medios hoy tan conocidos de una profilaxia segura.

Debido á la acción del director de la asistencia pública, Dr. Emilio R. Coni, ha sido posible contener la invasión de la enfermedad y reducirla en 1892 á cifras ciertamente menores que las de años anteriores. En este último año solo murieron 214 tifoideos en una población de 550,000 habitantes, casi lo mismo que en 1885 sobre 390,000 almas.

El decenio de 1883–92 ha suministrado la siguiente mortalidad tifoidea:

Año.	Mortalidad.	Proporción por 100,000 habitantes.	Año.	Mortalidad.	Proporción por 100,000 habitantes.
1883	180	55	1888	388	83
1884	193	58	1889	509	83
1885	209	55	1890	628	117
1886	272	69	1891	417	79
1887	279	65	1892	214	42

Sobre 100 defunciones generales corresponden á la fiebre tifoidea en Buenos Aires, en los años que se expresan, estas proporciones: En 1886, 2.72; en 1887, 2.38; en 1888, 3.22; en 1889, 3.55; en 1890, 3.93; en 1891, 2.89; en 1892, 1.47.

En 1890 alcanza esta enfermedad su mayor desarrollo aquí: 628 muertes sobre un total de 17,721 defunciones, esto es, 3.93 por ciento, la cifra más alta hasta hoy. En 1891, desciende á 417, y en 1892 el descenso se acentúa mucho más y la cantidad

de tifoideos fallecidos solo llega á 214, esto es, 1.47 por ciento de la mortalidad general. En los últimos años, los barrios más visitados por esta enfermedad han sido los inmediatos al puerto entonces en construcción, dársena sur, Boca, y en general toda la ribera y la parte sudoeste de la ciudad, sin descuidar los arrabales donde habita gente pobre y desaseada.

Las estaciones en que mayor número de individuos ataca son el otoño y el verano; si bien en invierno también invade como lo hemos visto en 1891-92. En esta predilección por ciertas estaciones podemos referir verdadera influencia á las lluvias de la primavera, las que favoreciendo la acción del verano preparan el terreno para que la enfermedad estalle. Esto se comprobó con ocasión de la epidemia tifoidea del año 1869, sobrevenida en dicha estación después de grandes lluvias.

En la "Casa de aislamiento" se asisten los individuos atacados de enfermedades infecciosas, y allí son trasladados los tifoideos que no pueden asistirse en sus domicilios. En el último año entraron en dicho hospital 130 de estos enfermos (tifoideos) y murieron 32. La mortalidad producida por estos representó el 14 por ciento en el año 1890 sobre lo general, y en 1891 el 13 por ciento.

La neumonía ha sido en 1892 desastrosa en intensidad y frecuencia. Sobre 14,612 defunciones generales le corresponden 1,144 (13 por ciento). Ha sido mucho peor que la tuberculosis (1,022) que siempre ha constituido un factor importante en la mortalidad.

Si á los 1,144 neumónicos agregamos los 936 fallecidos por bronco-neumonía, la proporción sube considerablemente. Y aquí entra de una manera positiva la influencia de la grippe que ha dominado especialmente en 1892 como en 1891, complicando muchos estados mórbidos, determinando las bronco-neumonías infecciosas y haciendo estallar la tuberculosis ó poniendo al organismo en condiciones de fácil receptividad.

Las cifras relativas á la neumonía y á la bronco-neumonía que acabamos de dar, son las más altas hasta ahora anotadas entre nosotros, y así vemos que en los últimos años han sido:

	1887.	1888.	1889.	1890.	1891.	1892.
Neumonía	802	811	1,016	1,075	910	1,144
Bronco-neumonía	303	303	642	583	520	936

Se recordará siempre de los inviernos de 1891-92 en que la influenza no dejó casa sin atacar, existiendo familias enteras que la sufrían al mismo tiempo. Esto que fué de observación común en la clínica privada, era más evidente en los hospitales, á los que acudían en cantidades extraordinarias los enfermos de grippe, neumonía y bronco-neumonía.

La influenza presente entre nosotros desde 1890 no ha dejado de hacer víctimas, y por el contrario ha contribuido poderosamente al aumento de las defunciones anuales. Sin contar las diversas complicaciones que la acompañan ha producido 182 muertes en 1892. Su acción ha sido evidente, incontrastable, y la intensidad del ataque tan grande, muchas veces, que hemos visto enfermos revolcarse en la cama buscando alivio á los dolores atroces que los atormentaban.

En la gran mayoría de los casos las formas benignas han predominado, pero en cambio ahí están las enfermedades del aparato respiratorio con su mortalidad en aumento en los últimos años que han sido los invadidos por la grippe, atestiguando sus consecuencias. Las cifras de neumonías y bronco-neumonía son espantosas. Aparte de los padecimientos anotados como favorecidos por ella, está la tuberculosis que el ultraje de la influenza despierta en el organismo de antemano debilitado.

Las modalidades más raras se han presentado á la observación clínica, y después de las complicaciones pulmonares que han sido las más comunes. las nerviosas han asumido un carácter acentuado de tenacidad y persistencia. En algunos casos se ha visto la fiebre tifoidea declararse y definirse bien en el curso de la enfermedad en cuestión.

En el invierno actual (1893) ella ha atacado muchas personas, pero todo hace presumir que no tendrá ni la marcha ni la fuerza de años anteriores.

La escarlatina disminuye notablemente al punto de que durante el año 1892 su mortalidad fué solo de 12.

El sarampión en cambio se ha mantenido elevado algunos años, y en 1892 su cifra no ha dejado de ser crecida. Comparemos la mortalidad de estas dos enfermedades:

	1887.	1888.	1889.	1890.	1891.	1892.
Escarlatina	62	17	17	26	11	12
Sarampión	141	99	261	80	54	188

La coqueluche aumenta aunque sus proporciones no son grandes. Sin embargo su mortalidad que fué de 35 en 1887, subió á 67 en 1888, á 85 en 1889, á 57 en 1890, á 91 en 1891; pero en 1892 se redujo á 29.

Los nacido-muertos en 1892 han alcanzado la cantidad de 1,271, inferior á la de los años 1888, 1890, y 1891.

Su proporción con la mortalidad general está representada en el siguiente cuadro:

	Nacido muertos.	Mortalidad general.	Proporción por 100 defunciones generales.		Nacido muertos.	Mortalidad general.	Proporcion por 100 defunciones generales.
1887	775	12,117	5.9	1890	1,304	16,417	7.6
1888	1,115	12,367	8.8	1891	1,312	13,014	10.1
1889	1,303	14,736	8.8	1892	1,271	14,612	8.7

La mortalidad infantil, por las elevadas cifras que desgraciadamente la representan, ofrece notorio contraste con el rápido progreso que tanto ha levantado á Buenos Aires en los últimos 15 años.

El hecho observado en todas partes se comprueba entre nosotros; los niños menores de un año pagan el mayor tributo en la mortalidad infantil, y anticipémonos á decir que mientras mueren de 1 año 36,568, como sucedió de 1875 á 1890 en Buenos Aires, mueren 16,653 de 1 á 2 años en el mismo término de 15 años.

La proporción de mortalidad para los niños de menos de 1 año establece que ella es de 17 por ciento entre nosotros, en tanto que en muchos países de Europa llega hasta 34, más de la tercera parte de los nacidos. El siguiente cuadro revela el número de nacimientos, niños muertos de 0 á 2 años, y sobrevivientes desde 1875 á 1890:

Años.	Nacimientos, no contando nacidomuertos.	Niños muertos de 0 á 1 año.	Sobrevivientes.	Niños muertos de 1 á 2 años.	Sobrevivientes.
1875	9,945	1,939	8,006	927	7,079
1876	9,647	1,463	8,184	521	7,663
1877	9,530	1,636	7,894	644	7,250
1878	9,656	1,540	8,116	571	7,545
1879	10,616	1,621	8,995	920	8,075
1880	10,077	1,582	8,495	761	7,734
1881	10,221	1,557	8,664	729	7,935
1882	11,137	1,671	9,466	921	8,545
1883	11,434	1,986	9,438	912	8,526
1884	12,551	2,117	10,434	1,022	9,412
1885	13,839	2,338	11,501	928	10,573
1886	14,003	2,745	11,258	889	10,369
1887	15,939	3,002	12,937	1,456	11,481
1888	19,119	3,291	15,828	1,315	14,513
1889	22,044	3,967	18,077	2,280	15,797
1890	23,020	4,113	18,907	1,857	17,050
Totals	212,768	36,568	176,200	16,653	159,547

Más adelante analizáremos estas cifras que son en sí muy desconsoladoras.

De las investigaciones del Dr. Coni resulta que desde 1875 á 1890 han muerto 53,221 niños de 0 á 2 años, clasificados así:

Aparato digestivo	12,320	Enfermedades de la nutrición [3]	78
Aparato respiratorio	10,002	Enfermedades génito-urinarias	184
Aparato circulatorio	298	Enfermedades de la piel	164
Enfermedades del sistema nervioso	8,104	Enfermedades de la sangre [4]	46
Enfermedades infecciosas ó localizaciones típicas [1]	10,500	Sin clasificación	7,391
Enfermedades infecciosas ó localizaciones variables [2]	4,134	Total	53,221

El predominio de las enfermedades infecciosas es notable; las 14,634 defunciones que ellas han producido representan el 27.4 por ciento y están así divididas según diagnósticos:

Tétanos	4,983	Disenteria	279
Viruela	3,356	Fiebre tifoïdea	244
Difteria y crup	2,529	Erisipela	172
Sifilis	802	Escarlatina	127
Tuberculosis (escrofulosis, tabes mesentérica, meningitis tuberculosa, etc.)	801	Varias enfermedades	25
Sarampión	759	Total	14,634
Coqueluche	557		

Las del aparato digestivo son también frecuentes, 12,320 (23 por ciento), están así clasificadas:

Gastro-enteritis	4,233	Hepatitis	97
Enteritis	2,838	Gastritis	86
Atrepsia	2,484	Fiebre gástrica	82
Entero-colitis	1,314	Colerina	57
Colera infantil	359	Diversas enfermedades	394
Indigestión	249		
Diarrea	126	Total	12,320

Las del aparato respiratorio, 10,002, representan el 18.7 por ciento y son estas:

Neumonia	5,140	Pleuro-neumonia y pleuresia	152
Bronquitis	2,575	Diversas	110
Bronco-neumonia	1,575		
Laringitis	140	Total	10,002
Congestión pulmonar	130		

[1] Sarampión, escarlatina, tifus exantémico, erisipela, herpes, viruelas, reumatismo articular, fiebres palúdicas, coqueluche, grippe, parotiditis, fiebre tifoidea, disenteria, cólera asiático y nostras, fiebre amarilla, tétanos y meningitis cerebro-espinal.

[2] Tuberculosis en sus diferentes formas, escrofulosis, sifilis, lepra, difteria, pústula maligna y rábia.

[3] Raquitismo.

[4] Leucocitemia, anemia perniciosa progresiva, clorosis, púrpura, hemofilia y escorbuto.

Las del sistema nervioso abarcan 8,104 (15 por ciento) y son las siguientes:

Meningitis	5,248	Hidrocefalia	232
Congestión y derrame cerebral	1,172	Meningo-encefalitis	172
Eclampsia	978	Encefalitis	143

De los cómputos mensuales se deduce que la mortalidad infantil entre nosotros ha llegado hasta 52 por ciento de la general, pero oscila al derredor de 44 y 46 por ciento. Estos datos son por demás alarmantes, y deben llamar la atención de las autoridades. En nuestra opinión las causas que obran para producir la gran cifra de mortalidad infantil en Buenos Aires son principalmente dos: el poco cuidado que muchas gentes tienen en la alimentación de los niños, y la ignorancia de parte de los encargados de administrarla. Coni (de Buenos Aires) dice que si el abandono de la lactancia materna ejerce una poderosa influencia sobre la mortalidad infantil, la alimentación prematura—causa de un gran número de enfermedades—suministra también á la mortalidad un contingente igual.

Las familias y especialmente las de las clases pobres tienen la perniciosa costumbre de dar á los niños en la primera edad alimentos de toda naturaleza, sin preocuparse si estos son poco ó no son nada asimilables. De allí, alteraciones profundas en el aparato digestivo (vómitos, diarreas, etc.), alteraciones consideradas de poca importancia y encerrando á menudo el principio de graves enfermedades. Las madres que recurren á la lactancia artificial, medida justificada ó no, ignoran casi siempre ciertos preceptos, tan sencillos como indispensables, para que esta manera de alimentación no ocasione malos resultados.[1]

Un hecho averiguado en el dominio de la patología infantil es la influencia de la alimentación, cuando esta se hace insuficiente ó defectuosa; y para salvar en lo posible este inconveniente se han establecido en Paris, Loussane, Berlin, y Stockolmo servicios especiales, habiéndose comprobado en la primera una disminución de las enfermedades del aparato digestivo en la primera infancia, desde que se cuida prolijamente de evitar la falsificación de la leche, sin que por lo que respecta á las dos últimas ciudades se pueda afirmar nada en absoluto, si bien hay que esperar buenos resultados de las medidas adoptadas.

En Francia existe una práctica que sería muy benéfica si las madres de familia se dieran el trabajo de obedecerla. Consiste ella en distribuir en las oficinas del registro civil, á los padres de los niños cuyos nacimientos se inscriben, un folleto conteniendo instrucciones sobre la higiene de la primera infancia; pero á menudo sucede que tales instrucciones no son leidas, y por consiguiente quedan ignoradas.

En cuanto á las estaciones en que mueren más niños, tenemos que las 53,221 defunciones de 0 á 2 años, producidas de 1875 á 1890, han ocurrido así:

Verano	14,808	Invierno	12,761
Primavera	14,088	Otoño	11,564

Es el verano la estación en que mayor número de muertes tiene lugar y aquí hay que considerar la acción del calor, la leche muchas veces alterada, las frutas, las malas aguas, los cambios de temperatura, y en muchos casos la falta de cuidado y de aseo. No hay más que penetrar en un conventillo para ver el triste espectáculo que ofrecen los niños, y comprender así la causa de la enorme mortalidad de la primera infancia. La ignorancia y el abandono de los padres son los elementos que más intervienen en este lúgubre cuadro.

En el mismo término (1885–1890) han muerto 3,858 niños de 5 á 10 años, así clasificados:

Aparato digestivo	222	Enfermedades genito-urinarias	87
Aparato respiratorio	385	Enfermedades de la piel	6
Aparato circulatorio	56	Enfermedades de la sangre	11
Enfermedades del sistema nervioso	398	Sin clasificación	207
Infecciones á localizaciones típicas	926		
Infecciones á localizaciones variables	1,547	Total	3,858
Enfermedades de la nutrición	13		

[1] Coni: Causes de la morbidite et de la mortalité de la première enfance à Buenos Aires, 1886.

Aún cuando el exámen comparativo con otros países nos sea favorable, debemos reconocer que estamos lejos aún de presentar datos que sean consoladores, y es satisfactorio decir que en este sentido se comprueba un movimiento que más tarde dará excelentes resultados.

El Patronato de la Infancia, institución creada á semejanza de algunas que existen en Europa, tiende en sus fines primordiales á disminuir los estragos de las enfermedades infantiles, fundando maternidades y asilos, consultorios médicos, vigilando la lactancia mercenaria, las fábricas donde los menores trabajan, y tratando por todos los medios posibles de poner la salud de estos en buenas condiciones para que se desarrollen fuertes de cuerpo y con el espíritu de trabajo que necesitamos para prosperar. No serán inútiles algunas consideraciones sobre el tétano infantil, muy frecuente en otro tiempo en Buenos Aires, y cuya disminución se acentúa hoy felizmente. Los datos del siguiente cuadro hasta 1890 pertenecen al Dr. Coni, y revelan la cifra de mortalidad que ella produce:

1875	436	1881	237	1887	183
1876	412	1882	241	1888	265
1877	430	1883	286	1889	398
1878	372	1884	264	1890	292
1879	308	1885	302	1891	319
1880	255	1886	302	1892	265

En estas cifras predomina el sexo masculino. En cuanto al momento de la vida en el cual la mortalidad es más crecida, es entre la primera y la segunda semana del nacimiento; en este período se produce más de la mitad de las defunciones que corresponden al tétano. El otoño y el invierno son las estaciones en que más niños mueren por esta enfermedad.

Antes de las teorías microbianas, el létano era en Buenos Aires de una frecuencia aterradora. Hoy que las parteras reciben buena instrucción práctica, y que los beneficios de la asepsia se desparraman y multiplican, se reducen notablemente sus víctimas. Siendo como es, el resultado de una infección (bacilus Nicolaier) la curación antiséptica y la conservación de una absoluta higiene se imponen.

La proporción de mortalidad infantil al año, en varios países, por 1,000 habitants, es esta:

	0 á 1 año.	1 á 5 años.	Sobre 1,000 habitantes de todas edades.		0 á 1 año.	1 á 5 años.	Sobre 1,000 habitantes de todas edades.
Italia	234.9	66.6	30.1	Suiza	220.1	23.1	23.8
Francia	179.8	27.5	22.3	Bélgica	176.3	34	24.6
Inglaterra y Gales	167.5	32.6	22.2	Países Bajos	195.5	30.3	22.8
Escosia	121.6	[1]59.8	22.6	Suecia	127.9	26.1	17.5
Prusia	222.2	40.6	25.9	Noruega	101.3	18.6	16.2
Baviera	319.6	[1]116.7	30.5	Dinamarca	151.9	20.9	19
Sajonia	312.3	[1]114.9	29.3	España	239.7	64.3	29.7
Wurtemberg	340.7	29.6	27.1	Portugal	----------	*132.5	20.5
Bade	268.9	29	25.5	Grecia	91.9	26.8	18.3
Alsacia-Lorena	240.9	33.4	27.9	Finlandia	165.6	38.1	21.5
Austria	230.2	52.8	30.1	Irelanda	96.8	19.3	----------

* De 0 á 5 años.

Según este cuadro Grecia é Irlanda presentan la estadística mortuoria infantil más reducida, en tanto que Wurtemberg, Baviera y Sajonia ofrecen cifras muy elevadas. Sabemos ya que en Buenos Aires la cifra de niños de 0 á 1 año que mueren es de 17 sobre 100 nacidos vivos, lo que le asigna condiciones mejores que muchos países de Europa, en vonde ese número es mayor. De los sobrevivientes al primer año en Buenos Aires muere el 9 por ciento en el segundo año. Desde el año 1885 á 1890, inclusive, han fallecido aquí 5,386 niños de 2 á 5 años, por las siguientes enfermedades: Infecciosas á localizaciones variables, 1,797; infecciosas á localizaciones típicas, 1,153; aparato respiratorio, 885; enfermedades del sistema nervioso, 729;

aparate digestivo, 432; enfermedades génito-urinarias, 92; enfermedades de la nutrición, 62; aparato circulatorio, 23; enfermedades de la sangre, 10; enfermedades de la piel, 6; sin clasificación, 195; total, 5,384.

En los últimos años nuestra mortalidad infantil de 0 á 1 año ha oscilado entre 24 y 28 por ciento de la general. Comparemos los datos que á este respecto ofrece París, según Landouzy y Napias, y veremos lo siguiente:

Años.	Mortalidad total.	Mortalidad infantil de 1 día á 1 año.	Mortalidad infantil de 1 año á 2 años.
1881	57,066	10,180	3,415
1882	58,702	10,541	3,320
1883	56,707	10,282	3,555
1884	56,970	9,970	3,803
1885	54,616	8,897	3,367

Así pues la mortalidad en los niños de 0 á 2 años en la capital de Francia, varia entre 23 y 25 por ciento de la total.

Los nacido-muertos en Buenos Aires han llegado á ofrecer muy lúgubre estadística, pues no solo interviene en ello el accidente natural de la muerte, sino que muy frecuentemente esta es el resultado del crímen.

Las casas particulares de partos, que hasta hace muy poco escapaban á la vigilancia de la asistencia pública, han sido en muchos casos los principales contribuyentes de esta entidad que la moral, la buena policía y la conveniente inspección harán disminuir. Otro factor que obra poderosamente para aumentar esta cifra es la ilegitimidad y con esta la miseria. El cuadro que sigue revela la proporción que los nacido-muertos representan en 100 defunciones generales en Buenos Aires:

Año.	Nacimientos generales.	Nacido-muertos.	Proporción de nacido-muertos con los nacido-muertos generales por 1,000.	Mortalidad general.	Proporción de nacido-muertos sobre 100 defunciones generales.
1880	9,401	220	23.4	7,073	3.1
1881	9,576	280	29.2	6,316	4.4
1882	10,477	352	33.6	7,196	4.8
1883	10,792	407	37.7	8,501	4.7
1884	11,870	413	34.8	8,242	4.9
1885	12,581	454	41.1	9,295	4.8
1886	14,003	517	36.9	9,994	5.1
1887	15,939	775	48.6	12,117	5.9
1888	19,119	1,115	58.2	12,367	8.8
1889	22,044	1,303	58.9	14,736	8.8
1890	23,020	1,304	56.6	16,417	7.6
1891	24,501	1,318	----------	13,014	10.1
1892	23,255	1,271	----------	14,612	8.7

Comparando los nacido-muertos en Buenos Aires y otras ciudades argentinas, tenemos:

	Años.	Media de nacido-muertos en 100 defunciones generales.		Años.	Media de nacido-muertos en 100 de funciones generales.
Buenos Aires	1887-91	8.2	San Nicolás	1889	5.3
Rosario	1889	5.5	Santiago del Estero	1889	.8
La Plata	1889	9.5	Bahia Blanca	1889	3.5
Santa Fé	1889	3.6	Concepción del Uruguay	1889	6.4
Paraná	1889	4.9			
Corrientes	1889	.5			

Y haciendo la misma comparación con algunas ciudades europeas, resulta.

	Años.	Media de nacido-muertos por 100 defunciones generales.		Años.	Media de nacido-muertos por 100 defunciones generales.
Buenos Aires	1887–91	8.2	Roma	1871–74	6.5
Viena	1865–74	5.3	Berlin	1869–73	5.7
Copenhague	1865–74	5.6	La Haya	1865–74	6.7
París	1866–75	8.4			

París y Buenos Aires ocupan los primeros lugares en esta estadística de mortinatalidad.

Buenos Aires, junio, 1893

METHODS EMPLOYED FOR THE PREVENTION OF DISEASE AND PRESERVATION OF THE LIVES OF THE INHABITANTS OF THE DISTRICT OF COLUMBIA.

By CHARLES M. HAMMETT, M. D.,

Health Officer of the District of Columbia.

I have the honor to appear among you as health officer of the District of Columbia, delegated to this congress by the honorable Commissioners, and I will proceed to state in as few words as possible the methods employed by the health department for the prevention of disease and preservation of the lives of its inhabitants. The ordinances of the health department, covering nearly all nuisances likely to occur injurious to health, were legalized by Congress and approved by the President on April 24, 1880, and we are now acting under these laws. The important features that may be spoken of are the system adopted for the issuance of permits for burial; the obtainance of information concerning births and marriages for statistical and other purposes; the method of inspections, especially that pursued during the present summer, of house-to-house visitations; the collection of garbage; the service of surveillance of houses infected with smallpox, scarlet fever, diphtheria, and other contagious diseases; the pound service; and the inspection of vessels arriving from foreign ports. The domiciliary inspection service was originated with a view to ascertain the sanitary condition of each and every house and premises within the District lines. It has been successful beyond my utmost expectations. During the period from March 17 last to the present time there have been 39,330 houses inspected. In these houses there resided 39,627 families, consisting of 190,718 adults, children, and infants. The number of rooms for their accommodation was 274,133. Closets and privies numbered 55,942. The water supply from the reservoirs from the Potomac River is 18,244; from hydrants in the public streets, 3,055; from wells, 4,619; cisterns, 69, and springs, 315. Over 13,000 nuisances of a minor character were found, which have been abated. This work has been done with an average force of twenty men.

The deaths for the following months, this and last year, were as follows:

	1892.	1893.
April	446	482
May	434	473
June	584	596
July	835	609
Total	2,299	2,160

Figures such as these, showing a gradual decrease in the number of deaths as compared with the increase in the population with the great finality of 196 less deaths during the month of July this year than last, is a most important evidence that house-to-house inspections, vigorously and faithfully carried out, as have been done here, with a competent force of inspectors, is one of the vital agencies to be employed. This, I consider, is one of the methods described so aptly by Dr. Mapother in his treatise on sanitary science for the maintenance of the health and life of communities by agencies in "common and constant use." The principles of physiology, pathology, and biology may be well carried out in this direction, supporting the cardinal idea of cleanliness. There are other agencies employed for the protection of the health of the inhabitants of the District of Columbia relating to sewers, drains, disposal of garbage and dead animals, disposal of the dead, etc., which may be spoken of as follows: Seventy-two thousand one hundred and thirty-eight healthy and vigorous trees are now growing upon the street lines of this city, and it is my belief that these trees have an important share in the healthful conditions surrounding us. We also have a free public bathing beach, which is used to the fullest extent whenever the weather will permit. More than 300 miles of underground sewers have been laid in the District of Columbia, at an approximate cost of $6,800,000. These afford ample drainage for our present needs and have much to do with our good sanitary condition. The work is still progressing and large appropriations have been made for its continuance. Since the commencement of the large system of improvements 3,500,000 square yards of various pavements have been laid and the appearance of our streets and alleys always strikes the eye of the observing visitor with surprise, the miles upon miles of smooth pavement affording excellent drainage toward the sewer openings. Most of the streets are kept scrupulously clean, and filth upon any street or alley is the exception rather than the rule. The condition of our public school buildings is also about all that could be desired in such structures, the closest attention being paid to ventilation, heat, closets, etc. They are inspected frequently and anything in the shape of unsanitary matters is speedily abated. As a consequence, the breaking out of epidemics or the spread of diseases through the agency of the public schools is nearly impossible.

Relative to the vital statistics of the District of Columbia, will say that to the casual observer deaths, as they occur in a community, seem to present no order nor law in regard to age, sex, or social condition. Individuals seem to fall as the leaves of autumn fall. Old and young, in the alley or on the boulevard, in the tenement house or Executive Mansion, pass away one by one. But when the death certificates are arranged and classified, either according to age or cause of death, it will be seen that chance plays no part in this drama, and that fixed and unchangeable laws govern the whole matter of life and death. Statistics post the account and strike the balance. They disclose how age and social relation, and even meteorological conditions, influence the rate of mortality. They point out the advent and growth of strange maladies and novel phases of old ones; how some seem refractory and incurable, whilst others may be met and overcome. They designate where certain diseases linger for years around certain localities, and how the taint of blood may sap the fountains of life down through successive generations. In short, they furnish data from which science may deduce conclusions as wonderful as that by which Jenner enabled mankind to successfully fight smallpox, or as grand as that of Pasteur or Koch which taught how disease may be made to abort disease. It is upon the principle that statistics are valuable only when used as means of comparison that the tables contained in the annual report of this department are mostly arranged. They contain, in addition to the results of the immediate year, serial tables covering groups of years, arranged conveniently for reference. Besides these tabular statements, but deduced therefrom,

are annually drawn up three maps of the city, upon which are noted the number of deaths by race that have occurred upon each square. There also may be found the exact square upon which deaths from consumption, typhoid fever, malarial fevers, diphtheria, scarlet fever, and diarrhœal diseases occurred. These charts are of great interest in showing the topography of mortality in the city, and are so highly esteemed by health officers in other cities of this country and in some European cities that they are being adopted as models from which to copy. The question would naturally arise as to whether these statements and arrangements of facts and figures show that progress has been made in limiting the death rate in this District, and has the average of human life been extended? By an examination of the tables it will be seen that the annual death rate has been gradually diminishing since the organization of this department. Commencing in 1876 with a rate of 26.4 per 1,000 inhabitants, and then falling in subsequent years to 25 and to 24, the report for the fiscal year ended on June 30 last shows a rate of but 22.6, a gain of 1,000 lives per annum. Proceeding further into particular classes, we find that the zymotic diseases present an almost corresponding improvement. Taking the last five years, the percentage of deaths from this class of maladies to the total mortality has declined from 24.2 in 1888–'89 to 20.5 in 1892–'93. As compared with the fiscal year 1892, there is an improvement of 1 per cent in 1893, and that condition, judging from subsequent reports, would seem to be continuous as to the immediate future. Mortality from typhoid fever, which has been as high as 208 in the year for two successive years, has decreased to 187 during the last year and to 183 in the preceding year. In the zymotic class diphtheria holds a prominent place as to frequency of attack and number of the victims and its fatal character. Until within two years there was no law by which the number of cases of this disease, and the location thereof, as well as deaths therefrom, in the District of Columbia, could be ascertained. During the year before last the number of cases occurring in the District amounted to 533, with 177 deaths therefrom. This was at a rate of mortality of 32 per cent of cases, or one patient out of every three dying. During the last fiscal year, under the operation of the same excellent law, the number of cases was 377, with 128 deaths, showing 49 reduction in the number of deaths and the large reduction of 156 in the number of cases. This result was attained by the rigid application of the law of isolation, which protects the public schools, the Sabbath congregation, all public assemblages, and the neighborhood from this deadly contagion. The scarlet-fever service comes under the same regulations as does diphtheria. In 1892 there were 385 cases of this disease reported, with 25 deaths. In the year just ended there were 209 cases, resulting in 7 deaths. Here was a decrease of 175 in the number of cases and of 18 in the number of deaths. The laws and regulations in regard to these diseases provide for complete isolation of the patient, the placing of warning cards upon the premises where the case exists, and the burning and disinfection of all material likely to have become a nidus for the germs. In this same class are included all those maladies embraced in the general term "miasmatic." In former years the malarial atmosphere of Washington afforded a fruitful theme for newspaper correspondents, and many excuses for physical conditions brought on by excess in living. Of late there has been a continued decrease in the number of so-called "malarial fevers" in fatal form. For the decade ending within five years ago the deaths from this class of diseases averaged annually from 110 to 112. Last year they amounted to 90, and in the year previous there were but 85. Say within the last five years the deaths from zymotic disorders have fallen from 24 per cent of the total mortality to 20 per cent.

Passing from the zymotic to the tubercular maladies, consumption demands most attention. Up to the great discovery of Dr. Koch as to the possible successful treatment of tuberculosis, the belief that pulmonary tuberculosis or pulmonary

phthisis might be arrested in its primary stages, or even in the more advanced conditions, had few if any advocates. But latterly the idea seems to have been gaining ground that this dread malady, even if hereditary in its origin, may be aborted or counteracted, if not cured, after having made serious invasion of the system. That pleasant and airy surroundings and good sanitation are influences which overcome a tendency to consumption may no longer be wholly controverted in view of the statistics of this city. The measures resorted to to clean up the place and its present sanitary condition have already been spoken of. In former years the deaths from consumption in this District averaged near 750 per annum. In the year 1884 they reached their highest mark, when they numbered 819. During the year 1892 there were but 714 deaths from consumption, while last fiscal year the number fell to 681, which is the lowest point since 1876, seventeen years ago, when they amounted to 579 out of a population of a little over one-half that now in the District. In this city the deaths from tubercular diseases have declined from 18.1 per cent of total mortality to 15.9 since 1889.

An unavoidable limit having been placed upon the extent of human life, the death rate can not by human agency be brought down to zero. While the foregoing statements go to show that certain diseases may be engendered and propagated by man's disregard of the law of life, there are others which seem to be inherited to humanity. These last will always claim their own. Among these are the nervous disorders, which cause annually in this city, with but little variation from year to year, 13 per cent of the total mortality. In the same class, diseases of the circulatory organs remain in fatal form at an even rate during the five years past, varying scarcely in that time from 5 per cent of total deaths. Since the advent of the catarrhal influenza in 1889–'90 the mortality from diseases of the respiratory organs has been greater than in former years. Previous to the year named the deaths averaged about 500 per annum, after which time they increased to 904 in 1891 and to 956 in 1892, and then declined to 905 in the fiscal year ended in June last, or 14 per cent of the total mortality, with indications of their return to original figures. The digestive organs were subject to the same influences. On an average in times past they have claimed 7 per cent of all deaths. In the past year they increased to 8 per cent, and from 444 in 1892 they rose to 525 in 1893. This increase was mainly attributable to cases of gastritis, gastric and gastro-intestinal catarrh, and enteric catarrh, many of which were no doubt superinduced by the expiring influence of the epidemic catarrh.

Among the innumerable new subjects now engaging the attention of the medical world infantile mortality is prominent. "Pediatrics" is the term applied to this branch of science. In this city no subject presents a more fruitful and useful line of research. Over one-third of all deaths in this District are of children under 5 years of age, and of these two-thirds are infants under 1 year old. During the year ended on June 30 last 2,361 children under 5 years and 1,770 under 1 year of age died. What may be the cause or causes and what the remedies for such conditions rest with the scientist and humanitarian. These are the facts as presented by the current reports

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LA EMBRIAGUEZ, SUS CAUSAS, SUS EFECTOS, URGENTE NECESIDAD DE DISMINUIRLA, ¿CUALES SERÍAN LOS MEDIOS MÁS ADECUADOS PARA OBTENERLO?

Por el Dr. SALVADOR GARCIADIEGO, México.

Este vicio deplorable que carcome á la sociedad y cuyo incremento la hará sentir cada vez sus terribles consecuencias, merece llamar la atención de los higienistas para ver si es posible detener sus avances y salvar á la humanidad de los males sin número que le acarrea.

El utilitarismo, el materialismo, el positivismo y los demás dictados con que se engalana el epicureismo moderno para disfrazar sus tendencias en medio de la algazara y del entusiasmo frenético que desarrollan en las masas los adelantos actuales para hacerlas creer que el lema de la escuela enciclopédica. "Gozar de la vida y de sus placeres sin ocuparse de un porvenir desconocido," es el fin á que deben aspirar y el que señala su destino sobre la tierra, nos ha conducido al borde del precipicio.

Desde que por una aberración inconcebible se han limitado los deberes y derechos sociales á disfrutar las comodidades y ventajas con que nos brinda el progreso material, sin reconocer más tasa que el perjuicio notorio de tercero y se profesa que la sociedad está fundada en la aglomeración de individuos que por un pacto tácito ó expreso han resuelto vivir en común para obtener los beneficios que trae consigo la reunión de elementos aislados, y que cada uno de estos debe prestar contingente al desarrollo y perfectibilidad indefinida á que está llamada la humanidad, se han erigido principios absolutamente erróneos como base de la sociedad, de cuya aplicación han surgido necesariamente el imperio de la fuerza, el valor del oro y la abolición de los deberes hacia Dios. Olvidando que la sociedad es un compuesto que debe tener de la misma manera que los tienen las partes que la forman, deberes marcados por una ley superior á las que emanan de las conveniencias materiales y cuya observancia es impuesta por el capricho humano y sancionada con una penalidad no relativa á los crímenes, sino atenuada en proporción de su frecuencia, y finalmente llevadas á efecto por la fuerza armada, no debemos extrañar que todos aquellos vicios que dañan en primer término á los individuos que se entregan á ellos, se hayan multiplicado hasta el grado que la sociedad resienta ya sus funestas consecuencias.

Bajo este punto de vista deben estudiarse las causas y efectos de la embriaguez, si se pretende disminuirla, supuesto que los medios empleados con ese objeto, hasta la fecha no han sido coronados con buen éxito. Parece que el desarrollo del progreso material en la sociedad ha venido á entorpecer sus adelantos en el orden moral, fenómeno que no debe extrañarnos supuesto que lo mismo acontece en el individuo considerado aisladamente, y la colectividad tendrá que perfeccionar, que desarrollar si se quiere, atributos que pudieran pasar casi desapercibidos en él; pero nunca será capaz de abolir las leyes naturales que lo rigen en su evolución normal.

Salvo excepciones, que por el solo hecho de serlo jamás constituirán una regla general, el desarrollo excesivo de las facultades motrices, de los sistemas y aparatos orgánicos que ponen en juego y de las afectivas retarda y aún suele amenguar la evolución de las mentales y vice-versa. Esta ley fisiológica, cuya verdad está al alcance de todos, ha servido de norma á los higienistas para recomendar encarecidamente que en la educación de los niños y jóvenes se procure con empeño que haya paralelismo y simultaneidad en el desarrollo de unas y otras.

Inculcar á la niñez los deberes del hombre hácia el Ser Supremo, para consigo y respecto de la sociedad, fijando en su memoria los desastrosos efectos de los vicios por medio de anécdotas ó historietitas que impresionan vivamente en esta tierna edad, representándole en toda su desnudez y repugnancia la degradación á que conduce la embriaguez y que es el semillero de los vicios y desgracias que minan nuestra sociedad actual, para que los niños le cobren horror desde sus primeros años. Seguir un plan análogo para la educación de la juventud y ser inexorables los directores de los colegios de instrucción secundaria con los alumnos que desgraciadamente se inclinen á dicho vicio, y continuar el mismo método y una disciplina severa en los colegios profesionales. Este medio dará excelentes resultados para el porvenir, siempre que se tenga especial cuidado de premiar, á la par que los adelantos científicos y aún con preferencia, la buena conducta de los alumnos.

Respecto del presente, no siendo posible educar hombres, sí lo es corregirlos, y la manera más adecuada es servirse de la penalidad impuesta á la embriaguez. Debe tenerse presente que el que se expone voluntariamente á perder su razón y á entregarse á excesos cuya trascendencia ni él mismo puede medir, es doblemente culpable, primero, por la falta que comete privándose de su razón, y segundo, por los actos que en tal estado puede ejecutar y ejecuta de ordinario cuando se embriaga, circunstancia agravante y que debe tenerse en cuenta por el legislador, pues sabido es que individuos pacíficos se tornan pendencieros y aún asesinos con los vapores del vino. Que la legislación jamás atenúe el delito cometido por un ebrio de oficio ni del que voluntariamente y á sabiendas de los efectos del alcohol sobre el cerebro se exceda en la bebida, que la penalidad impuesta á los crímenes perpetrados por individuos en estado de embriaguez, sea mayor y efectiva, y puede asegurarse sin temor de engaño, que el número de consuetudinarios disminuirá. Habrá necesidad de algunos ejemplares, quizás podrá tacharse de severa esta manera de proceder, pero el resultado práctico vendrá á hacerle justicia, y las ventajas serán reportadas por la sociedad. Si la legislación moderna es tan indulgente con los criminales, buscando razones para excusar hasta cierto grado los delitos á la sombra de la perversión de instintos, de la degeneración moral de ciertos individuos, del estado en que los coloca la embriaguez, la consecuencia forzosa es que la sociedad está desarmada delante de los agresores de sus intereses, so pretexto de no condenar al reo que en el acto mismo de perpetrar el crímen no disfruta del pleno uso de su razón.

Cuando á los degenerados, epilépticos, locos de impulsión, etc., se les vigila y se les segrega de la comunidad para sustraerla de sus tiros, causa pena y extrañeza que no se proceda de igual manera con los ebrios de profesión. Todavía tratándose de estos últimos, tendría que ventilarse la cuestión de si tienen conciencia del acto criminal que ejecutan y el vino solamente los priva del temor natural de ejecutarlo por las penas con que se castiga un hecho de este género en un cuerdo, circunstancia que aumenta su audacia con la perspectiva de la inmunidad relativa, ó si realmente deben calificarse como privados de razón.

La importancia del asunto demanda algunas consideraciones médico-legales sobre los efectos del vino en las facultades que constituyen la razón humana, y la apreciación que han hecho de ellos algunas legislaciones vigentes en la actualidad. Después de este estudio sucinto, sería del mayor interés para nuestras legislaciones y para la sociedad, que se fijaran reglas de conducta para el juez y el perito, á fin de poder determinar con precisión cuales de los actos cometidos en estado de embriaguez podían estimarse concientes, y cuales voluntarios en la causa, y por tal motivo siempre imputables.

Los códigos de Austria, Prusia y Baviera dicen que ningún acto puede ser reputado criminal cuando su autor se encuentre en estado de ebriedad completa y accidental.

En Inglaterra, según Blackstone, la legislación criminal afirma que la falta de voluntad en el ebrio en el momento del crímen, lejos de servir de excusa, agravará el delito porque debía no embriagarse y ser dueño de sí mismo. Eduardo Coke ha dicho: "Un ebrio es un demonio voluntario que es responsable de los males que pueda causar durante la vehemencia del vino." La legislación norteamericana es análoga. La ley de Georgia, sin admitir como excusa la embriaguez, exceptua el caso de haber sido ocasionada por artificios de un tercero. El código de Wurtemberg establece una distinción entre el ebrio y el consuetudinario; teniendo indulgencia con aquel y siendo muy severo con este, para castigar el delito y el vicio. En general se cree que la frecuencia de actos criminales de tal ó cual género debe suavizar la penalidad de los códigos respecto de ellos; mas es muy importante tener presente la rigidez de la legislación inglesa que contraria

esta regla, pues es tan común en dicho país la embriaguez, que asegura Taylor, que si la estimasen como excusa las tres cuartas partes de los criminales quedarían impunes.

La embriaguez presenta tres períodos según Hoffbauer: (1) Exitación ó exaltación de las facultades mentales y de la fuerza física, hilaridad, buen humor, alguna incoherencia en el lenguaje y frases indecentes, integridad de los sentidos y conciencia plena. (2) Depresión. La imaginación decrece y se extingue, la voz se eleva y aparece la turbulencia, la circulación cerebral es más activa, la respiración se acelera, los sentidos se debilitan, y al fin se embotan, los movimientos son inciertos, la pronunciación torpe, los miembros vacilan, la incoherencia del lenguage muy manifiesta, la memoria y la voluntad desaparecen, las pasiones se encienden y estallan con el más ligero pretexto produciendo arranques irresistibles, favorecidos por las frecuentes alucinaciones é ilusiones que acompañan este estado. El hombre en tal situación se asemeja mucho al maniaco, y es tan peligroso para los demás como para sí mismo. (3) Coma. Un sueño profundo, apoplético, caracteriza el último período de la ebriedad, el individuo sumergido en él, extraño á los objetos que le rodean, inofensivo para la sociedad, aparece como una bestia que resiste al frío y al contagio, como lo ha establecido Double, por que ha perdido los caracteres propios del hombre y se ha colocado en una escala inferior. Existe además otra forma de embriaguez: la convulsiva. Al describirla Percy y Laurent se expresan en estos términos:

Diez hombres pueden apenas dominar á esta especie de fieras. La mirada es feroz, los ojos centellantes, los cabellos erizados, los gestos de amenaza, rechinan los dientes, escupen la cara de los circunstantes, muerden á los que se les aproximan, les hincan las uñas si tienen las manos libres, escarban la tierra y prorumpen en ahullidos espantosos. Si por desgracia están á solas, pueden arrojarse por la ventana, herirse, rodándose por el pavimento ó estrellarse la cabeza contra las paredes ó la cama. Hemos visto perecer dos desgraciados de esta manera.

La duración de la embriaguez es muy variable y guarda proporción con la aptitud individual, la naturaleza y cantidad de las bebidas espirituosas, la composición de las falsificadas, la costumbre de embriagarse, etc., de suerte que es muy difícil determinarla, á pesar de ser importantísima esta circunstancia para el juicio pericial, porque el juez necesita saber si en el momento de la perpetración del delito se encontraba su autor en el segundo período de la ebriedad, que sería el que pudiera excusar parcialmente la responsabilidad de un acto, por hallarse disminuida la inteligencia y exaltados los sentimientos afectivos; que los cometidos en el primer período ó después que el segundo había terminado, deberían ser imputables, porque en uno no se pierde aún el uso pleno de la conciencia y después del otro la razón recobra sus derechos. Omitimos ocuparnos del tercero, porque es imposible ejecutar actos violentos en él; el individuo se ha convertido en cosa y la personalidad ha desaparecido.

Respecto de la embriaguez convulsiva, del período de delirium tremens y del estado de embrutecimiento moral y físico en que suelen caer los consuetudinarios, el primero se relaciona con los accesos furiosos del maniaco, el segundo con los actos inconcientes de un enfermo delirante y el tercero constituye un estado particular que merece nuestra atención. Bajo el punto de vista médico-legal el abuso de la bebida, si no viene acompañado de delirio, confirmado y permanente, no debe aumentar ni disminuir las consecuencias del acto cometido, solamente debilitará ó disipará la sospecha de la embriaguez intencional con fines culpables; tal es el sentir del distinguido alienista Legrand de Saule, que al ocuparse de la materia añade:

No puede concebirse que el hábito de la embriaguez alcance de los magistrados graciosa deferencia, cuando su misión los llama á perseguir el escándalo y condenar la inmoralidad.

La embriaguez periódica ó intermitente dimana de la perversión, la sensualidad, la imitación y la disolución de costumbres. (Marc.)

La acción de la justicia contra ella es soberana y su fallo dependerá de la apreciación discreta de la moralidad del hecho. (Legrand de Saule.)

La historia de las desgracias ocasionadas por la embriaguez es un largo y sombrío martirologio. (Dumesnil de Quatre-Mares.) Cinco siglos atrás, en 1349, á propósito de este asunto el prefecto municipal de Rouen dijo: De veinte bandidos ó salteadores, diez y nueve se han formado en las tabernas.

Licurgo embriagaba á los ilotas para inspirar á los ciudadanos horror por la ebriedad. Aristóteles y Quintiliano afirmaban que agravaba al crímen y que debería castigarse con una pena independiente de la que aquel reclamaba, por ser una degradación voluntaria, la cual nunca podría ser medio de justificación ni crear una excusa.

Se mejoran la plantas con el cultivo y el hombre con la educación. (Rousseau.) En el día, la educación es prodigada con largueza y sin embargo el mal hace progresos. La sociedad exije que se dicten medidas reprensivas; para tener buen éxito, preciso será herir el corazón. (Legrand de Saule.)

Los progresos deplorables del alcohol y sus efectos desastrosos conducen á los más eminentes pensadores, no solo á rehusar á la embriaguez el carácter de excusa legal (lo cual había ya proclamado la jurisprudencia del tribunal supremo tiempo ha, considerándola en sus sentencias como hecho voluntario y reprensible que jamás podrá constituir una excusa capaz de ser acogida por la moral y por la ley), sí que también á reputarla circunstancia agravante del crímen y de la penalidad. La asamblea nacional en 1871 se ocupó de este punto, y entre los esfuerzos intentados en esta vía, los más enérgicos y mejor dirigidos fueron presentados por el Dr. Teófilo Roussel. (Tardieu.)

El código francés hace punto omiso del estado de embriaguez, dejando en libertad á los jueces para calificar la responsabilidad (Briand et Chaude), medida muy sabia que puede poner á salvo los intereses de la sociedad y los derechos del hombre, porque el magistrado falla á impulsos de su conciencia y no de la ley escrita. La historia, la legislación de países demasiado ilustrados, y la opinión de médicos-legistas, tan eruditos y prácticos como los que hemos citado, vienen en apoyo de la moral y de la filosofía para demostrar una vez más que el individuo que voluntariamente se coloca en condiciones que puedan arrastrarlo á cometer actos punibles concientes, semiconcientes ó inconcientes, es doblemente responsable por renunciar á la razón deliberadamente y obedecer á ciegas los instintos de sus malos hábitos; que los delitos cometidos bajo la influencia del alcohol deben ser castigados, y que la embriaguez no debe estimarse circunstancia atenuante, ni atenderse al desarrollo que ha alcanzado en nuestra época, porque siempre que los códigos suavicen la penalidad por tal consideración, lejos de corregirse, crecerá á sus anchas, contando con la impunidad relativa de ser castigados como faltas, sin calificarse de crímenes imputables los atentados perpetrados á su sombra.

Es bien lamentable que la trasgresión de las leyes del deber ejecutada por un hombre honrado en un momento de desgracia en olvido de sus deberes, sea castigado con la severidad impuesta por la legislación, al paso que delitos mucho más repugnantes, llevados á cabo por individuos que corrompen y vician las costumbres sociales, encuentren una egida que les sirva de amparo, trayendo á colación en su defensa y á título de excusa, un vicio que corroe á las sociedades modernas, y que echará más hondas raíces toda vez que la legislación lo tolere y aún lo proteja indirectamente, atenuando las penas con que se reprimen los actos punibles de sus adeptos.

Ya hemos referido la opinión de Taylor, en la cual se nota la confesión ingenua del estado deplorable que ofrece el pueblo inglés por su afición á la bebida, y que si fuera admitida la embriaguez como excusa legal ante el jurado, tres cuartas partes de los criminales gozarían de impunidad.

Que nos sirva de ejemplo esta lección para que jamás lleguemos á semejantes extremos; que nuestros legisladores fijen su atención sobre cuestión tan importante y opongan un dique á los avances de un vicio que después de destruir al

individuo, disolver la familia y perturbar el orden y decoro social, se perpetúa en la descendencia marcando sus huellas con lesiones cerebrales y faltas de desarrollo físico y moral; que declaren responsables de sus actos á los consuetudinarios, para que si no obtienen la desaparición de la intemperancia, hayan cumplido, por su parte, la alta misión que desempeñan, vigilando por el bienestar de la comunidad y reprimiendo los actos que la trastornan.

PALUDISMO.

Por el Dr. ANTONIO JOSÉ AMADEO.

Doctor en medicina de la Universidad de Pensilvania, M. R. C. S. E., etc.

Prescindiremos del saneamiento de los campos, y lo que pertenece á la higiene pública, para ocuparnos de los medios de preservar al individuo. Son raras las fiebres palúdicas, siempre que haya buenas viviendas en sitios elevados, secos, alimentos suficientes y vestidos apropiados al clima (telas de algodón), evitando las fatigas corporales, las mojaduras, los excesos de todo género y los enfriamientos repentinos. Cuando existe una endo-epidemia, se deben tomar al acostarse seis ú ocho granos de sulfato de quinina cada dos ó tres días, manteniendo el vientre libre con el uso de naranjas dulces y algunas tomas de bicarbonato de soda.

Los agricultores no deben salir muy temprano sin desayunarse.

El café negro por la mañana y la cerveza con agua al medio día, cuando hay mucha sed sientan siempre bien. Lo mismo las fricciones alcohólico-aromáticas después de los enfriamento repentinos y mojaduras. El sereno es uno de los peores enemigos, y las malas noches pasadas en bailes, orgias, viajando producen la intermitente. La constipación debe combatirse con ligeros laxantes.

TRATAMIENTO.

Hay individuos que se curan las intermitentes sin tomar ningún medicamento, por la sola fuerza de la naturaleza; su privilegiada organización para eliminar de la economía substancias tóxicas, ó tal vez como cree Mr. Laveran y sus secuaces, debido á la fagocitosis destruyendo los hematozoos de la malaria. Bastan para cortar una palúdica simple tomar quince granos de buen sulfato de quinina al terminar el acceso; ocho granos más al día siguiente, y doce granos siete días después, dos veces seguidos para evitar las recidivas. Contra los síntomas gastro-biliosos, un vomitivo de tartrato de potasa y antimonio, seguido de un purgante de calomelano. El arsénico y demás sucedaneos de las preparaciones quínicas, no son tan eficaces contra las manifestaciones palúdicas. Las personas de diátesis artrítica tienen aquí calenturas accesionales (simulando el impaludismo), que resisten á la quinina y se combaten con el arsénico y las aguas minerales termales. (Baños de Coamo.)

En la remitente con síntomas biliosos: un vomitivo de tártaro emético; un purgante de calomelano, seguido de otos de aceite de recino son remedios eficaces. Las prevenciones contra del antimonio carecen absolutamente de fundamento, considerándole siempre muy superior á la ipecacuana, que reservamos para las personas muy debilitadas. Hasta en los niños produce los mejores efectos. La antipirina después de abundantes sudores rebaja la temperatura y prepara el organismo para la administración pronta de los antiperiódicos por todas las vías. En toda pirexia remitente ó sendo-continua, deben combatirse inmediatamente las congestiones locales; lo mismo que sostener la hipercrinia intestinal para eliminar sin demora de nuestra fábrica los productos nocivos ó tóxicos. Los infartos crónicos del bazo é hígado, requieren los revulsivos, el yoduro de potasa, y hasta el

mercurio, cuyo último medicamento según nuestras observaciones, en vez de empobrecer más la sangre, mejora sus condiciones y favorece la nutrición. Desde tiempo inmemorial se emplean aquí por el vulgo, para curar las intermitentes palúdicas, la quina caribœa el agenjo (*Partenium histerophorus*), el quinino del pasto (*Phillantus niçuri*), la hedionda (*Cassia occidentalis*) el Condeamor (*Monordica charanta*) y otras plantas tónicas con la ayuda de purgantes drásticos.

La anemia se combate con los buenos alimentos, el cambio de lugar y las aguas minerales, sódicas y ferruginosas. El hierro, la mayor parte de las veces, produce constipación, perturba las funciones digestivas, y no da los resultados que se esperan. La hidroemia en los niños, no tiene tanta gravedad como en los adultos, y se cura con los vegigatorios al bazo, á la región hepática, purgantes drásticos, los tónicos, y cambio de residencia con una buen alimentación.

Varias son las hipótesis sobre la acción de la quinina, pero hasta hoy no se conoce bien su manera de obrar. Creese que triunfa de la intermitente destruyendo los hematozooarios de Laveran, mas ya hemos dicho que no siempre se encuestran estos micro-organismos en las fiebres palúdicas, siendo una teoría como otra cualquiera, hasta que no se haya dicho la última palabra sobre la naturaleza y fuerza infecciosa de estos raros parásitos. Lo que no debe ponerse en duda, es la acción pronta, fortificante de las sales de la quina sobre el sistema nervioso, por lo que creemos combaten las palúdicas, estando indicadas en todas las enfermedades de esta zona cuando hay intermitencia y periodicidad aunque sean independientes del impaludismo. Son un neurosténico poderoso, indispensable, sin igual, en la terapéutica de estos países. En los estados adinámicos no tienen rival.

SECTION XIX—PHARMACOLOGY.

Executive President,
Prof. Jos. P. Remington, Ph. M., F. C. S.

Secretary,
Prof. F. G. Ryan, Ph. G.

Foreign Secretary.
Prof. A. W. Miller.

ADDRESS OF THE PRESIDENT OF THE SECTION, PROF. JOS. P. REMINGTON, Ph. M., F. C. S.

Gentlemen: It becomes my duty, as executive president of the section of materia medica and pharmacology of this congress, to address you upon this occasion, and to lay before you the reasons which have actuated the executive committee in establishing this section. The Pan-American Medical Congress, the first to convene in America, has for its mission the establishment of closer relations between the members of the medical and allied professions of the Western Continent. When we consider the enormous advances which have been made in the last century in all matters pertaining to the development and advancement of the human race, it is remarkable that so many years have elapsed, and that so many opportunities for mutual assistance have been permitted to drift away, until they finally rest in that unfathomable abyss which is filled with lost opportunities and shattered hopes. The medical and scientific literature of this country, with its wealth of accumulated facts and valuable researches, and the practical results flowing from the labors of the eminent men who have enriched American medicine and pharmacy with services which have received recognition in nearly every country, have been utilized freely all over the world, and yet we meet here to-day in the closing years of the century and find that our brethren to the south are still drawing their supplies, still sending the results of their researches, and still looking to the old countries across the water for their inspiration and for their intellectual help. The establishment of closer relations between the members of the profession of the Western Continent will not bar the communication which has been so long established with the mother countries. There is ample room for more. The old truism still stands, "Knowledge begets knowledge," and there is no reason why North and South America should not join hands, drawing from each other what is best in each, and in turn gleaning from the older countries all that can be gathered; and, although constantly adding to the accumulated stock, forever reaching out and possessing the resources of each to the fullest extent. Fortunately, the bounds

for the acquisition of knowledge can not be selfishly limited by any nation. Opportunities for advancement are all but universal in application, and universities are established all over the world. A glance at those great storehouses of technical information, our dictionaries of chemistry and encyclopedias of pharmacological facts, will disclose the names of scientists from all countries attached to the various subjects. Of late years the universality of science has received a wonderful impetus through the marvelous development of electricity, which seems to be destined to annihilate space and to swallow up the difficulties which stand in the way of the universal communication of thought and work between man and man. The varied climate and soil of South America have produced in times past a multitude of plants having very marked characteristics, and while a number, like cinchona, coca, jaborandi, ipecac, and others which are well known, have found their way into commerce, there is little doubt that the unexplored fastnesses would reveal to the explorer a large number of valuable drugs with which to enrich our materia medica, while the possibilities of cultivating many which have already proven their value gives abundant hopes for the future. Commerce and civilization are to-day almost synonymous terms. If South America can furnish the crude products from her soil, North America stands ready, with her marvelous facilities for refining and manufacturing, to present to the world finished products fitted for the use of the physicians of both continents. Why should not the north and south join hands in friendly commercial intercourse? The barrier which looms up at once is this, the wide difference in the standards used for medical practice in the two countries. Until the present time the systems of weights and measures were unlike. The adoption of the metric system by the Pharmacopœia of the United States of America has effectually settled one great difficulty, but another remains. The preparations of the United States Pharmacopœia and the preparations used by the pharmacopœias of South America differ in important particulars, and while it can never be expected that a Pan-American pharmacopœia could take the place of the official standards of the different countries, because these are regulated by law, there would seem to be no real objection that can be urged against the gathering into a Pan-American pharmacopœia of such drugs and preparations as are used in both countries, establishing standards for identification and purity which will aid in bringing order out of chaos and establishing a basis upon which the practice of medicine made by the physicians and the dispensing of remedies by the pharmacist can be carried on with safety and success. It would probably not be wise to aim at first at the production of an elaborate work; only such remedies as have proved to possess value should receive recognition, and such remedies which are indigenous to North America should be incorporated. It would not be desirable to introduce any substance or preparation in such a pharmacopœia which was controlled by copyright, trade-mark, or any monopoly; but after prescribing tests for identity or purity, every step should be taken to make the manufacture or collection of the substance as free as possible, so that any citizen in either of the countries should have the free right to collect or manufacture, provided he furnishes honest products at fair prices. We are here to-day to discuss and possibly to take the first steps toward the realization of such a project, and the first problem which should be settled is the desirability of having a Pan-American pharmacopœia. Then how shall it be prepared? What shall be its scope? What language shall it be published in? How shall it be published? Who shall constitute the committee to perform the labor? These questions can all be satisfactorily answered at this congress, and upon this section will devolve the important duty of inaugurating the movement, if in its judgment it seems proper to do so. In conclusion, gentlemen, as your presiding officer, I must ask for your kind indulgence, trusting that our deliberations may prove of service to the great movement in which we hope to bear successfully such portion of the burden as is laid upon us.

DISCUSSION.

A. W. MILLER. It is comparatively easy to prepare a pharmacopœia, but it is infinitely more troublesome to have the same adopted and generally accepted. We must not overlook the fact that our South and Central American friends are somewhat conservative, and that they are jealous of anything savoring of dictatorial interference in their home arrangements. I therefore feel strongly convinced that no pharmacopœia prepared solely by us will ever meet with general recognition in the countries to the south of us. In my private opinion, the only feasible plan for the preparation of a Pan-American pharmacopœia will be to follow out the idea outlined in the president's address, namely, to have official representatives appointed by each of the Governments of Central and South America, which gentlemen are to be intrusted with this important subject. I apprehend that this will be a labor of several years, that the amount of correspondence will be enormous, that mutual concessions will have to be made, but that all this procedure will be absolutely necessary so as to insure the uniform acceptance of the new standard as an official authority in all of North and South America.

Mr. F. B. KILMER, New Brunswick, N. J. As for the association, I represent the State of New Jersey, and I indorse the plan of a Pan-American pharmacopœia. A recent examination of some of the pharmaceutical preparations of South America, and conversation with pharmacists and physicians is convincing of the need of the same. The medical practice of South America is as progressive as that of other parts of the world, but for various reasons different and older standards than ours are favored. Pharmacy in this section does not fulfill all modern demands. A Pan-American pharmacopœia would probably have to be of a much wider scope than our own or even an international pharmacopœia. It would have to embrace many preparations similar to our national formulary. In fact, this formulary was recently commended and purchased for use by a pharmacist in these States. If this section can furnish the initiative and secure the coöperation of representatives of these countries we may be able to mutually aid pharmacy in all the nations by an interchange of pharmaceutical standards and methods.

PROCEEDINGS.

FIRST SESSION.

WASHINGTON, D. C., *September 5, 1893.*

The section was opened by the executive president, Prof. Joseph P. Remington, at 3:30 p. m.

The president requested the secretary to read the call for the meeting of the section, after which the president read his address.

Dr. A. W. Miller moved that the address be received and a committee of two be appointed to consider the suggestions made therein.

Seconded and carried.

The president appointed Dr. Robert W. Greenleaf, chairman, and Dr. A. W. Miller, to report at the next session.

On motion of Dr. Miller the section adjourned.

SECOND SESSION.

Called to order by the president at 3:30 p. m.

Minutes of the first session read and approved.

Dr. A. W. Miller moved that, as the President of the United States of America had appointed 5 p. m. as a time to receive the members of the congress, this section take a recess at 4:45, and resume business after the reception.

Seconded and carried.

Dr. Robert W. Greenleaf, chairman of committee on president's address, made report as follows:

The committee appointed to consider the address of the executive president respectfully report that they fully approve of the various suggestions contained therein for furthering fraternal relations between the American Republics. We regard with especial favor the proposal for a Pan-American Pharmacopœia, particularly since listening to the remarks in the discussion which were brought out by the reading of the address. We feel very strongly convinced that the earlier this highly important matter is undertaken the better it will be for all the nations of North and South America. We therefore recommend that this subject be taken up for further deliberation at our next meeting.

Report received and adopted.

Dr. H. H. Rusby, New York, reported that the section on therapeutics had passed a resolution, as follows:

PROJECT FOR THE FORMATION OF A PAN-AMERICAN PHARMACOPŒIA

The advantages which the pharmaceutical and medical professions derive from the uniformity of medical formulæ are well known, and this has led to the formation of pharmaceutical codes. The amount of drugs and preparations of American origin are already so numerous that it becomes necessary to embody them all in a work that will afford to the medical profession a ready means of consulting a therapeutic guide for their daily practice, the work being an exponent of the resources that our continent, so rich in natural productions, affords. The compilation of that pharmacopœia can be intrusted to medical professors of all the countries on the American continent, who would hold the character of collaborators, continually forwarding their contributions to the editorial center located in some one of the American nations. In furtherance of this object, and without hesitation, we offer with the utmost sincerity the National Medical Institute of Mexico, where for years past our scientific labors have been carried on with the view of acquiring all the necessary data for the pharmacological and therapeutical study of our national products. It is well known that our establishment contains departments devoted to the study of natural history, chemistry, experimental physiology, therapeutics, climatological and medical geography, and clinics, and that, therefore, it has at its disposal the best elements for those classes of studies. Should this project be realized, one of the great advantages to be derived from it will be that of placing in personal contact all the members of the medical profession throughout America and their interchange of information with regard to the resources which therapeutics can rely on throughout the continent will be an efficacious aid in fulfilling the duties of our profession. To insist on setting forth the importance of this plan would be an offense to the enlightened and learned body of my honorable colleagues, and I therefore submit to their consideration the following propositions: (1) All the nations of America will adopt a uniform pharmacopœia which will be denominated the Pan-American Pharmacopœia; (2) a committee of physicians and pharmaceutical chemists of all the American countries will be appointed, said committee to be intrusted with the formation of the above-mentioned work, compiling for this purpose all the pharmacopœias of America, and increasing it with the data that they may acquire; (3) this congress will appoint the central commission as also correspondent members resident in all the countries of America and will also fix the residence of the central committee.

This resolution was proposed by Dr. Rusby and seconded by Dr. Cerna in the section on therapeutics, and carried.

The following resolution was offered by Prof. Joseph P. Remington:

Whereas the section on pharmacology of the Pan-American Medical Congress, believing that there are many drugs, plants, and vegetable substances belonging to the South American flora which can be profitably added to our materia medica whose properties have never been investigated, and with the object of aiding in the development of these valuable resources of the Western Hemisphere: Be it therefore

Resolved, That this section recommend to the executive committee of this congress the organization of a Pan-American commission, whose duty it shall be to encourage the discovery of such drugs and provide for a thorough and exhaustive examination of the physical, chemical, and therapeutical properties of the same through the use of the best means known to modern scientific research.

Adopted.

The following resolutions were offered by Dr. H. H. Rusby:

Resolved, That this section recommends that steps be taken toward the preparation of a Pan-American pharmacopœia.

Resolved, That a committee of three be appointed by the chair, and that the section on therapeutics be requested to appoint a similar committee, the two committees to act jointly in formulating a general plan for carrying out the above idea; this plan to be presented, with recommendations by the two sections, to the executive board of this congress.

Mr. Burroughs moved its adoption.

Carried.

Resolution by Dr. H. H. Rusby:

Whereas the health of the community is a consideration of the highest import to the commonwealth, and the means for the prevention and cure of sickness should be brought without impediment within the reach of all members of the community; and

Whereas any artificial increase in the cost of antiseptic substances, drugs, mineral waters, and pharmacological preparations of known and stated composition tends directly to interpose such impediments to their use; and

Whereas the present tax upon medicaments and pharmaceutical substances constitute such an increase which weighs especially hard upon those whose wage-earning power is, by disablement, impaired and diminished, and inasmuch as artificial enhancement of cost is especially injurious to the sick poor, acts as a tax on the charitable funds of hospitals, and drives many to dispensaries and other public charitable institutions who would otherwise be enabled to supply themselves with the necessary medicine: From these and other considerations it is hereby

Resolved by this pharmacological section of the Pan-American Medical Congress, That it is inexpedient and contrary to public policy and injurious to the best interests of the community, and especially of the industrial classes and of the sick poor, that any tax or duty should be levied upon drugs and pharmaceutical preparations of known and stated composition; and that Congress is hereby earnestly and respectfully prayed to remove and remit all such existing taxes and duties, so that the means of preserving health and of averting and curing sickness may be placed at the disposal of the people without any artificial enhancement of cost.

Moved to adopt. Seconded and carried.

The section called to order after a recess of half an hour.

The president appointed Dr. H. H. Rusby and Dr. Adolph Miller a committee on Pan-American pharmacopœia, to act with a similar committee representing the therapeutic section.

Adjourned.

MATERIA MÉDICA Y FORMULARIO MÉDICO DE VENEZUELA.

Por el Dr. ENRIQUE MEIER FLEGEL,

Secretario de la Sección de Materia Médica y Farmacología del Congreso Médico Pan-Americano.

Úsanse en Venezuela, con preferencia, las sustancias medicamentosas sancionadas por los estudios y experiencias de los laboratorios y clínicas europeas y americanas, ciñéndose para su aplicación á las prescripciones del Códex y de las farmacopeas británica y americana principalmente, modificando cada médico las

fórmulas según las necesidades de la clínica, como se verá en las fórmulas que van al fin de este estudio. Las sustancias de origen vegetal propias del país, usadas científicamente son pocas, á pesar de haber muchas de un uso popular extenso, y que no creemos desprovistas de propiedades; pero que necesitan el estudio fisiológico y la esperimentación terapéutica. La mayor parte de los datos aquí recopilados, que se relacionan con nuestra flora propia, los hemos tomado de la materia médica de Benítez y el médico botánico criollo de Grousurdí. El Dr. J. A. Rísquez, que en su continuo anhelo de saber é investigar, había emprendido ya este trabajo, nos suministró gran parte del material, y nuestros maestros, los Dres. Elias Rodríguez, Nicanor Guardia, J. M. de los Rios y Calixto González, eminentes profesores que nada tienen que envidiar á las notabilidades extrangeras, nos han ayudado con las luces de su propia experiencia y las fórmulas que una larga práctica ha sancionado.

Para todos nuestras más expresivas gracias por su valiaso contingente.

PLANTAS DE VENEZUELA USADAS POR LOS MÉDICOS DEL PAÍS.

(1) *Albahaca* (*Oxymium bacilicum, Labiadas*).—Planta tropical que crece con abundancia entre nosotros; sus hojas tienen un sabor fuerte, picante y agradable. Se usa en cataplasmas como resolutiva; aplicada sobre la frente hace arrojar los gusanos de la nariz y de los senos frontales. El zumo de la planta se usa como diurético. Se asegura que algunas gotas instiladas en los ojos devuelven á la córnea su trasparencia. Mezclada con mirra se aplica al tratamiento de la ciática. Contiene mucho alcanfor y el Dr. Bodard la propone como sucedánea de él.

(2) *Aguacate* (*Persea gratissima, Lauras persea, Lauráceas*).—Árbol de hermoso follaje, con hojas ovales y gruesas, flores arracimadas y amarillentas, fruto de color verde y colgando de grandes pedúnculas. De la fruta se saca un aceite fijo, amarillo verdoso, algo acre y que contiene laurina; las semillas contienen gran cantidad de tanina, y se aplican machacadas en forma de cataplasmas en los panadizos para abortarlos; tostadas y pulverizadas, finalmente, se usan para el tratamiento de las diarreas y disenterías; este mismo polvo mezclado con aceite se aplica con resultado para el tratamiento del hidrocele incipiente. El cocimiento de las hojas se usa para el tratamiento de la bronquitis crónica, y se asegura que la corteza es util en las fiebres intermitentes.

(3) *Algodón* (*Gossypium canadensis, Malváceas*).—Además de los usos conocidos en cirugía, recomiéndase el zumo de las hojas como anexosmótico para los niños y analgésico para los dolores de oido; las hojas para el reumatismo crónico y carbunclos, aplicadas localmente; la cajilla del fruto, majada y tierna, destruye los clavos de la buba; el aceite de la semilla se emplea en la tos.

(4) *Algarrabo* (*Himenea curbaril*).—Contiene una sustancia resinosa que brota por las contusiones hechas en el tronco y en la raiz, la cual se usa en fumigaciones para el tratamiento del asma. Con la resina se prepara un bálsamo que se usa en los dolores reumáticos y en las ulceraciones de mal carácter. La corteza del árbol es á la vez purgante y carminativa, y se usa también como vermífugo. Contiene una semilla farinácea que puesta en maceración con aguardiente da una bebida agradable y algo purgante, perdiendo con el tiempo esta última propiedad. Algunos creen que la resina del algarrobo es el bdellium de los antiguos.

(5) *Algalius* (*Abel moschus moschatus*).—Las semillas de esta planta tienen olor á almizcle muy pronunciado y contienen un aceite fijo, mucílago, una sustancia albuminosa y una resina. En Guayana se usa como antiespasmódico para el tratamiento del tétano. Se conoce también con el nombre de almizcle vegetal, y se usa como sucedáneo del almizcle de Tonquín.

(6) *Amapola* (*Plumieria alba*).—La infusión de las hojas de esta planta tiene virtudes pectorales, y se usa en la bronquitis para calmar la tos, y especialmente en la tosferina.

(7) *Borrajón* (*Heliotropicum indicum*).—Planta como de media vara de alto, de la cual se usa la cataplasma de las hojas como resolutiva y la infusión como sudorífica.

(8) *Brusca* (*Cassia occidentalis, leguminosas*).—Planta de media á una vara de alto. Se usa como antiespasmódico, febrífugo y emenagogo. El cocimiento se aplica en la dismenorrea, cólicos uterinos, supresión de los loquios y el reumatismo.

(9) *Bejuco de cadena* (*Schenella splendens*).—Se usa como sudorífico y antiblenorrágico. Entra en la preparación de casi todos los jarabes depurativos que se preparan aquí.

(10) *Calaguala* (*Planta cryptógama, Polypodium crasifolium*).—Se utiliza la raiz, que es cilindroidea, bermeja, cubierta de fibras largas en cocimiento, como diurética y sudorífica. Contiene una sustancia que parece goma, una resina roja, amarga y acre, una sustancia parecida al almidón, ácidos málicos y silícicos, cloruros de sodio y materias colorantes.

(11) *Chiquichique* (*Cassia indecora, leguminosas*).—Se usa el zumo y el cocimiento de las hojas y flores como febrífugo, en bebidas y lavativas. Contiene mucho mucílago y se recomienda especialmente para el tratamiento de las fiebres biliosas.

(12) *Coco* (*Cocus nucifera*).—La cubierta fibrosa de la nuez contiene tanino y gran cantidad de aceite. El perispermo de la fruta contiene albumina, un aceite fijo, goma, azúcar no cristilizable, sustancia colorante, fibrina, caseina y agua. El agua de coco se usa como diurético, especialmente adicionada de ginebra, contiene azúcar, albumina y agua. Del fruto verde se prepara un jarabe de gusto agradable y que recomiendan como pectoral. (Véase la fórmula.)

(13) *Conopia* (*Rencalmia, sylvestris.*)—El pericarpio del fruto da una tinta morada. Se prepara un aceite usado como resolutivo y calmante.

(14) *Cruceta real.*—Arbol mediano que crece con abundancia en todo el oriente de la república, donde goza de mucha fama como amargo estomático y febrífugo. El Dr. E. Fernández lo ha usado en Caracas para el tratamiento de las fiebres intermitentes inveteradas, con buenos resultadas.

(15) *Congrina.*—Esta sustancia tiene propiedades antireumáticas de gran valor, machacada y puesta en maceración con alcohol, obra eficazmente en los dolores musculares.

(16) *Dividive* (*Cesalpinea coriara, Cesalpinaceas*).—Los frutos contienen de un 30 á 40 por ciento de tanino. El polvo y el cocimiento se usan con ventaja en las gangrenas, en las cardialgias y dispepsias, y tiene las demás aplicaciones de los tánicos.

(17) *Durazno.*—El cocimiento de las hojas de esta planta se usa en las afecciones herpéticas y en el exema.

(18) *Eneldo* (*Fœniculum vulgare, Anethum fœniculum*).—En los cólicos ventosos ejerce notable acción la infusión de esta planta, especialmente en los niños de pecho, asociado al bicarbonato de soda ó la magnesia.

(19) *Espadilla* (*Crotalaria stipularia, leguminosas*).—Yerba de más de media vara de altura, habita sobre las colinas secas, da flores amarillas, sus frutos son legumbres de algo más de media pulgada de largo, oblongadas, sin divisiones y con varias semillas de forma semilunar, prendidas á la sutura superior de la legumbre. Se usa como antiflogística y sudorífica, el zumo de las hojas, en el tratamiento de las fiebres inflamatorias y en el de las insolaciones.

(20) *Esponjilla* (*Luffa purgans, cucurbitaceas*).—Planta rastrera y abejucada habita lugares cálidos y húmedos. El tegido reticular exterior puesto en infusión con agua caliente, hasta que tome un gusto amargo, es purgante enérgico. Se usa como antireumático, como contraveneno general y en el tratamiento del tétano.

(*21*) *Escorzonera* (*Craniotaria annua*).—Planta con flores muy bellas que exhalan un olor almizclado bastante fuerte y fastidioso. La raiz perpendicular y gruesa está cubierta de una corteza negruzca que se rompe con facilidad, dejando al descubierto una película amarilla que es la parte más exterior de la corteza, la cual es blanca y blanda y de una á dos líneas de espesor; la parte carnosa de la raiz también es blanca y de un sabor acuoso y dulce. Se usa el zumo, el cocimiento y un jarabe, recomendándola como laxante, emenagoga y antisifilítica.

(*22*) *Fregosa* (*Capraria biflora, escrofularineas*).—Se usan las hojas en infusión y cocimiento como sudorífico y el zumo como antidisentérico, sobre todo en enemas. Posee un principio estimulante, análogo por sus efectos á la terna. Tomada en grandes cantidades produce embriaguez, debilidad general, somnolencia, debilidad de la memoria y hasta vértigos.

(*23*) *Guácimo* (*Guazama ulmifolia, bitueriáceas*).—Su corteza, muy cargada de mucílago, se usa como emoliente y emenagogo, preparada por simple maceración en agua.

(*24*) *Guatamare Cereipo* (*Microspermo frutecens, papilionaceas*).—Sus frutos son aromáticos y agradables; se usan en tintura y en aceite como anti-espasmódicos y anti-reumáticos.

(*25*) *Guaritoto* (*Yatopha urens y Vitifolia*).—Se usa para la urticación y sus raíces son un poderoso hemostático.

(*26*) *Gengibre* (*Zingiber officinale, zingiberaceas*).—La raiz de esta planta nudosa, tuberosa, de un color amarillo y de un sabor picante, se usa en infusión como carminatívo y estimulante de los órganos digestivos.

(*27*) *Guaco* (*Planta del genero Mikanica*).—Se emplean tres especies de guaco, el morado (*M. radicans*), el blanco (*M. scandens*), el verde (*M. Gonoclada*), de las cuales la más estimada es la primera, en la cual predomina un principio amargo; en la segunda, uno aromático, y en la tercera, uno astringente. Se usan las hojas y los tallos en zumo, cocimiento, tintura, extracto, etc. Es un agente poderoso preconizado como preservativo y curativo de las mordeduras de culebra, y el tónico de preferencia en los estados supuratorios.

(*28*) *Llantén* (*Plántago major, plantagineas*).—Se emplea el cocimiento ó el zumo de las hojas como detergente y astringente en las úlceras, flujos sanguíneos serosos y purulentos.

(*29*) *Merey* (*Anacardium occidentale, anacardicas*).—Planta muy cultivada en América y en las Indias Orientales. Se emplea el fruto y el pedúnculo piriforme, rico en un jugo muy astringente. Del fruto se extrae por expresion un aceite esencial contenido en su mesocarpo, y el cual está dotado de propiedades causticas que utilizó, siempre, el Dr. D. Beauperthin, notable médico del oriente de la república dedicado al estudio de nuestras plantas, y que escribió una excelente monografía sobre la lepra; la principal aplicación que él hacía de este cáustico era para destruir los tubérculos de los leprosos. Dicho aceite es líquido, trasparente, algo viscoso, insoluble en la agua, muy soluble en el alcohol sea frío, sea hirviendo, en el éter, aceites fijos, y grasas. El amoniaco y el agua de sosa ó potasa cáustica lo disuelven con facilidad, y tratado por un ácido mineral se obtiene una sustancia sólida, algo soluble en el agua y ácida probablemente el ácido anacárdico. A la parte cáustica del aceite le ha dado Hoedler el nombre de cardol. Se usa como cáustico y vesicante y reemplazaría con ventajas á las cantáridas. Creemos que esta sustancia merece que se estudie con detención.

(*30*) *Mango* (*Mangifera indica*).—Tanto el fruto como las demás partes del árbol contienen cierta cantidad de tanino, un líquido resinoso, sin color, y con olor análogo á la trementina, el cual sale por las cortaduras hechas en la corteza del árbol ó en los frutos verdes; su sabor es quemante; se espesa expuesto al aire; pero no se solidifica. De la corteza usada como febrífuga, asegura el Dr. Dumontel de San Tomás, haber extraido una sustancia á la cual le dió el nombre de

mangotina, y la cree superior á la quinina en el tratamiento de las fiebres intermitentes. Con el fruto se prepara un jarabe pectoral, y con las semillas otro muy encomiado para el tratamiento de las diareas crónicas.

(*31*) *Orégano* (*Lippia micromera*).—Esta planta aromática, anti-espasmódica, es áltamente estomacal, y se usa con ventajas en la disuria espasmódica.

(*32*) *Pasote* (*Chenopodium ambrosioides, salsolaceas*).—Domina en esta planta un principio aromático, nauseabundo y muy picante. Se emplea el zumo ó la infusión de las hojas contra las indigestiones, y se prepara un aceite anti-helmíntico. En cataplasmas como resolutivo.

(*33*) *Piñón* (*Jatrapha curcas, euforbiaceas*).—La almendra de esta planta encierra un aceite acre de acción vomipurgante enérgica.

(*34*) *Raíz de mato* (*Aristoloquia barbata, aristoloquias*).—Se usa con gran ventaja en todas las hemorragias, principalmente en las que se producen en las fiebres infectivas, como la remitente hemorrágica, amarilla, disentérica, gangrenosa y fiebre hematúrica. Tiene propiedades estimulantes y astringentes y un principio aromático. Es superior á la trementina y á otros astringentes, según el Dr. J. M. de los Rios. De esta planta solo se usa la raiz, bajo la forma de infusión, tintura y extracto.

(*35*) *Rosa de montaña* (*Brownea, leguminosas*).—La madera del tronco y las hojas contienen un principio astringente que la hacen utilizable en polvo y en cocimiento como astringente y hemostático.

(*36*) *Sauco* (*Sambucos virginiana*).—Las flores de esta planta usadas en infusión son sudoríficas, los tallos y las hojas tienen propiedades vomipurgantes, y entra en la poción conocida con el nombre de antidisentérica, cuya benéfica acción diariamente explotamos y que ha sido vendida por tanto tiempo como remedio secreto con el nombre de "Específico del Dr. Laloubie."

(*37*) *Totumo* (*Cresentia cryete, cresentiaceas*).—Se utiliza el fruto para la preparación de un jarabe muy recomendado en la tisis, abcesos hepáticos, y contusiones internas.

(*38*) *Torco*.—El polvo de esta planta se usa en la gastralgia y en todas las formas de dolores espasmódicas también se aplica en la diarrea atónica.

(*39*) *Tamarindo* (*Tamarindus indica, leguminosas*).—La pulpa del fruto del tamarindo se usa como laxante y atemperante. Es de un color rojo oscuro, de un gusto ácido azucarado; entra en la composición de la conserva de Vargas, preparación del célebre médico venezolano de este nombre, y que se aplica con excelente resultado para el tratamiento de las afecciones hepáticas.

(*40*) *Túatúa* (*Yatropa gossipifolia, euforbiaceas*).—Se usa con frecuencia la infusión de esta planta como laxante, y según la energía con que se quiera obrar se aumenta la dósis.

(*41*) *Verdolaguilla*.—Esta planta crece en los tejados, tiene un principio amargo pronunciado, y es muy usada como diaforética y febrífuga en las formas maláricas no muy intensas.

(*42*) *Yerba mora* (*Solanum nodiflorum, solariaceas*).—Esta planta tiene propiedades narcóticas, y se usa en cataplasmas con sustancias grasosas, en todos los casos en que es necesario atenuar el dolor con aplicaciones locales, dando muy buenos resultados en el tratamiento del herpes, zona, erisipelas, etc.

(*43*) *Yagrun* (*Ceropia peltata, artocarpeas*).—Se usan las hojas, yemas y parte leñosa del tronco del yagrumo morado, recomendádolo como sucedaneo de la digital. Esta planta ha sido estudiada especialmente por el eminente Dr. G. Michelena, el cual refiere haberla usado siempre con muy buen resultado para disminuir el número de los latidos cardiacos. En el asma lo usaba mucho el Dr. Antonio Rodríguez, catedrático de terapéutica y materia médica, y el Dr. Rísquez lo usa como antiasmático, cuando hay intolerancia por el yoduro de potasio. La planta es muy mucilaginosa, y no se ha podido encontrar en ella ningun alcaloide.

(44) *Yuca* (*Manihot utilisima. euforbiaceas*).—La raiz de esta planta contiene una gran cantidad de fécula, y un principio venenoso (ácido cianhídrico) que se separa por el lavado, el fuego y la fermentación. De ella se extrae el almidón, que remplaza en Venezuela el almidón de trigo; y con sus rasuras se prepara el pan llamado cazabe, empleado para cataplasmas.

PREPARACIONES MÁS USADAS.

Los jarabes de las sustancias antes mencionadas se preparan con 400 gramos de la sustancia madre, 4,600 de agua y 11,500 de azúcar; se pone todo al fuego y se reduce á la mitad. El jarabe de coco se prepara en el fruto mismo, agregándole 500 gramos de leche de vaca y 240 gramos de ajúcar; se tapa bien y se hierve en baño maría por media hora. El jarabe de tortumo se prepara introduciendo en el centro del fruto, previamente dividido á traves de una abertura practicada en la corteza, dos ó tres cucharadas de vinagre y otras tantas de miel de abejas. Se pone á la parilla ú horno, y cuando se ha reblandecido el fruto, se separa y esprime filtrando.

Conserva anti-ictérica de Vargas.

Pulpa de tamarindos	120	Hojas de sen pulverizadas	30
Id. de naranjas	120	Agua	720
Crémor tártaro	30	Azúcar	960
Ruibarbo en polvo fino	8		

H. S. A. electuario.

Poción anti-disentérica.

Raiz de ipecacuana machacada	30	Agua hirviendo	360
Cogollos de oauco	30	Tártaro emético	.05
Sulfato de sodio	30		

H. S. A. Ocho cucharadas cada hora hasta efecto emeto-catártico.

Polvos antidispépticos.

Carbonato de hierro	2	Colombo en polvo	4
Bicarbonato de sodio	3	Canela pulverizada	1

M. Para hacer papeletas de á 1.0. Dr. E. Rodríguez.

Colutorio contra las aftas.

Agua de rosas	6	Glicerina	30
Clorato de sodio	3		

M. Dr. I. M. de las Rios.

Contra la dismenorrea dolorosa.

Acetato de amoniaco líquido	15	Elixir paregórico	10
Tintura de anís	5	Agua	240

M. Dos cucharadas por dosis. Dr E. Rodríguez.

Otra.

Tintura de belladona	10	Tintura de azafrán	10
Tintura de cáñamo indiano	10	Codeina	.50

M. Diez gotas por dosis. Dr. I. Y. Cardozo.

Poción antidispéptica.

Sulfato de quinina	2	Clorato de potasio	2
Acido muriático diluido	2	Infusión de Serpentaria de Virginia	180

M. Una cucharada cada 3 horas. Dr. J. M. de los Rios.

Contra la bronquitis capilar.

Infusión de jaborandi	100	Agua de laurel cerezo	4
Hágase poción gomosa y agréguese:		Jarabe de ipecacuana	30
Extracto de acónito	.05		

M. Una cucharada cada hora. Dr. E. Meier Flegel.

Polvos tónico-reconstituyentes.

Canela pulv	1	Lactofosfato de cal	5
Carbonato de hierro	5	Hipofosfito de sodio	5
Quina calisaya pulv	5	Pepsina	10

M. y h. pptas. de á 3 gramos, dos á cuatro por día. Dr. A Feo.

Poción antiasmática.

Ioduro de potasio gramos	15	Alcohol de 30°	60
Infusión de polígala, 5 por ciento	60	Tintura de cochinilla	2
Jarabe diacodio	60		

M. Una á cuatro cucharadas por día. Dr. Risquez.

Contra la cirrosis hepática.

Fosfato de sodio	10	Alcoholato de menta	15
Agua destilada	300	Tintura tebaica	2

M. Dos cucharadas por dosis. Dr. E. Rodríguez.

Píldoras antidisentéricas.

Ipecacuana	.10	Opio	.20
Salol	2		

M. Para 20 píldoras, 1 cada 3 ó 4 horas. Dr. J. M. de los Rios.

Otra.

Sulfato de quinina	1	Extracto fl. de cornezuelo de centeno	1
Ipecacuana pulv	.75		

M. Para píldoras en la disentería febril con hemorragia. Dr. E. Meier Flegel.

Otra.

Sulfato de quinina	1	Extracto gomoso de opio	.10
Alcanfor	.50		

M. Para 8 píldoras. Dr. E. Rodriguez.

Poción anti-colérica.

Bicarbonato de sodio	2	Agua destilada de menta	100
Clorato de potasio	1	Elixir paregórico	5
Cloruro de sodio	.75		

M. Una cucharadita ó cucharada por dósis. Dr. Risquez

Poción tónico—estimulante.

Carbonato de amoniaco	3	Sulfato de quinina	3
Mistura alcanforada	180	Tintura de digital	3

M. Por cucharadas en la pulmonía. Dr. J. M. de los Rios.

Contra la hemicránea.

Sulfato de quinina	1	Polvos de digital	.50

M. Para 10 píldoras; una en ayunas. Dr. E. Rodríguez.

Poción anticemética.

Oxalato de cerio	1	Jarabe de éter ó de azahares	40
Muriato de morfina	.10	Agua destilada de laurel cerezo	10
Muriato de cocaina	.10		

M. Agítese antes de usarse. Una cucharadita por dosis. Dr. Risquez.

Poción febrífuga.

Muriato de quinina soluble	3	Tintura de acónito	3
Agua destilada	180		

M. Una cucharada cada 3 horas en la fiebre remitente con energía del corazón; la misma fórmula con tintura de digital, en vez de la de acónito, si hay atonía de dicho órgano. Dr. J. M. de los Rios.

INDIGENOUS DRUGS OF CENTRAL AND SOUTH AMERICA.

By ADOLPH W. MILLER, M. D., PH. D.

By far the most important and valuable contribution made for centuries to the storehouse of materia medica has been furnished by the primeval forests of South America. The tree named after the pious and charitable Countess of Chinchon has proved itself to be a veritable blessing to suffering mankind. It has made human existence possible in the jungles of India, in the fever-stricken Campagna of Italy, in the lowlands and marshes of Holland, in the territory of the bayous of our sunny South. Without it, many of the present homes of modern culture and civilization would inevitably sink back into barbarism. It is recognized as an indispensable necessity for the explorer of the interminable forests covering the interior of Africa. Not even the fertile brain of a Rider Haggard dared to send his hero into "*Africa horrida sylvarum*" without an abundant supply of quinine. Truly it fully merits the title that has been aptly bestowed upon it—"the tree that is for the healing of the nations." Ipecac root and jaborandi leaves from the dense forests of Brazil; balsam of Peru from the *Costa del Balsamo;* jalap root, the *rugbarbo de las Indias*, from the Mexican Andes; sarsaparilla root from Central America; and coca leaves from Peru and Bolivia have been accepted into the official pharmacopœias of most of the civilized nations. Their therapeutical virtues are thoroughly recognized and their consumption is enormous. The collection and preparation of these important drugs naturally adds materially to the wealth of the countries producing them. The prodigious richness of the Central and South American flora, which has furnished us so many highly valuable therapeutic agents, unquestionably conceals many further treasures from the discovery of which the medicine of the future will profit to the glory of science and the welfare of humanity. When the enormous extent and great fertility of the vast countries south of the United States are considered, it is somewhat surprising that the medical resources indigenous to them have of late years received comparatively little attention. It is well known that almost innumerable varieties of medicinal plants exist there in great profusion, and that the aborigines have from time immemorial made use of them. At rare intervals the attention of the profession has been directed to a few of these drugs, but the difficulties of obtaining regular supplies in sufficient quantities have so far proved an almost insurmountable barrier to their general introduction. It is also quite possible that the spirit of commercial enterprise which characterized the introduction of some of these new medicinal agents may have prejudiced many minds against them. Without a doubt many of these drugs were extolled far beyond their intrinsic merits, and frequent disappointment was then a natural sequence. It would therefore seem to be an eminently proper task for the Pan-American Medical Congress to consider the desirability of the diffusion of more accurate and definite knowledge of those medical productions of Central and South America that have not so far received the full measure of attention that they would seem to deserve. The noble and ideal aim of the American Republics should tend toward the establishment of such reciprocal relations that the chemical and pharmaceutical productions of our splendidly equipped Northern laboratories could be exchanged for equal values of rude drugs furnished by the virgin soil of Mexico, Honduras, Guatemala, and all of South America. The sufferers and the afflicted of all nations and climes, the great army of the lame, the halt, and the fever stricken, would be the true gainers of such fraternal and equitable traffic. The careful preparation, promulgation, and general recognition of a Pan-American pharmacopœia would be a very important step in this direction. Its acceptance by the members of the medical and pharmaceutical profession in the sister Republics would be of very great value in fostering feel-

ings of mutual esteem and friendship. Even if such an official publication would confine itself to the more active and energetic preparations, where uniformity of strength and dose is highly important, it would still be of immense and constantly increasing value in view of the rapid advances in our modes of travel and communication.

The following memoranda on a few of the lesser-known drugs of Mexico and Central and South America have been collected chiefly for the purpose of presenting in a classified form a synopsis of the recent literature of this branch of the study of materia medica. The number and extent of these notes, which have been condensed as much as possible, may serve as an index of the importance of this subject. The constant aim in their preparation was to extract only points of interest to the general practitioner, and to omit details of chemical, microscopical, pharmaceutical, and botanical investigations. The plants are presented in the order of their botanical relationship according to the arrangement of Prof. Asa Gray.

MAGNOLIACEÆ.

Coto bark.—Ever since the introduction of coto bark into Europe, in 1873, the true botanical origin of this valuable drug has been a matter of diligent inquiry. Dr. Theodor Schuchardt at last succeeded in obtaining the botanical material; flowers, fruit, leaves, and branches, necessary for the determination of the source of the true coto bark. Dr. Karl Schumann announces this to be *Drimis Winteri*, Forst., var. *granatensis*, Eichl. This tree is a native of the Province de los Andes of Venezuela, growing at altitudes of 2,500 to 3,000 meters, near to the borders of the United States of Colombia. (Amer. Drugg., Feb. 1, 1891, p. 37.) The tree is therefore botanically very closely related to the *Drimys Winteri* which furnishes Winter's bark. This drug was first brought to England toward the end of the sixteenth century by Capt. Winter, who accompanied Drake on his voyage around the world. At that time it was obtained from the Straits of Magellan, but it was also met with as far north as Chile. True coto bark appears to be an aromatic drug of great promise in the treatment of diarrhœa and colic. It has been subjected to very careful chemical examinations by Wittstein, Jobst, and Hesse, who have succeeded in isolating a number of active principles from it. The most important of these is cotoin, which has been given in doses of three-fourths grain by Dr. Burkart. Its value in the treatment of diarrhœa has been confirmed by various clinicians. Paracotoin, an analogous active principle extracted from so-called paracoto bark, is claimed to have been successfully used by Prof. Balz, of Tokio, Japan, in the treatment of Asiatic cholera, for which purpose 3 grains were injected hypodermically. The crude powdered bark and an alcoholic tincture prepared from it proved to be specifics for diarrhœa in the hands of Dr. von Gritte. Based on their physiological experiments, Dr. von Gritte and Dr. Burkart, however, claim that both the true coto and the paracoto barks are objectionable in their crude form on account of their secondary action on the stomach but they confirm the specific virtues of cotoin and paracotoin as remedies for diarrhœa. (Liebig's Annalen, p. 199.) Most of the commercial supplies of coto bark are furnished by Bolivia.

MONIMIACEÆ.

Boldo: *Peumus boldus*, Molina, 1782; *Rinzia fragrans*, Pav.; *Peumus fragrans*, Pers.; *Boldoa fragrans*, Gay; *Boldoa fragrans*, Sul. An evergreen shrub found in the mountain meadows of the Chilean Andes. Its yellowish-green fruit is edible, its bark is used in tanning, and its wood in the making of charcoal. The leaves contain a large amount of volatile oil in special cells, and they are the part used in medicine. MM. Bourgoin and Verne separated a peculiar alkaloid from them, which they named boldine. P. Chapoteaut has also obtained a glucoside

from them, on which he bestowed the title boldoglucin. This is said to act as a narcotic on the lower animals. It was administered with apparent success by Dr. René Juraviller as a calmative and hypnotic remedy in a case of insanity. An essential oil has also been obtained from boldo by distillation, which produced warmth in the epigastrium in doses of 15 minims; half a dram of it gave rise to considerable gastric irritation, with pain and vomiting. A strong smell of the oil was then imparted to the urine. Dujardin-Beaumetz has employed 5-drop doses of it advantageously in genito-urinary inflammation. The leaves have also been used in France as a tonic in chronic hepatic torpor and in hepatitis. For this purpose 8 minims of a 20 per cent alcoholic tincture have been given at a dose, which was gradually increased. Large doses are apt to induce emesis and purgation. In South America the drug is used in gonorrhœa and in chronic catarrh of the bladder. The commercial supplies of boldo leaves are now mostly obtained from the cultivated districts. The shrub is never found in forests, nor outside of Chile. It attains a height of 5 or 6 meters, and it has cylindrical, opposite branchlets. The leaves are reddish brown in color, entire, oval, opposite, coriaceous, with prominent midrib. They have a fresh aromatic taste and odor, recalling that of the *Lauraceæ* and *Labiatæ*. The Chileans make necklaces and rosaries of the very hard kernels of the fruit. M. Claude Verne has published formulas for an extract, sirup, tincture, wine, and elixir of boldo, all of which have been employed in the Hôtel-Dieu and Hôtel Beaujon in cases of atony of various organs, when the patients have been unable to tolerate quinine. Large doses were, however, followed by vomiting. (Ph. Journ. Transc., Nov. 21, 1874, p. 405; Am. Journ. Pharm., Nov., 1884, p. 580.) Dr. Charles W. Zaremba states that at a conference of the Sociedad Medica of Santiago de Chile the following summary of the therapeutics of boldo was accepted: Boldo is a most useful and profitable remedy in blenorrhagia. It gives good results in dyspeptic affections, when these are due to atony or debility of the digestive organs, or when they are complicated by bilious disorders. The administration of boldo is often advantageous in catarrh of the bladder. Boldo is an important auxiliary in the treatment of hepatic abscesses, when the febrile symptoms have been overcome. Powerful anthelmintic virtues are also claimed for boldo. (Parke, Davis & Co.'s Brochure No. 8.)

ANONACEÆ.

Fruto de Burro: *Xylopia longifolia*, D. C. The long-leaved bitter tree flourishes throughout the valley of the Orinoco. Its fruits enjoy quite a reputation there as a febrifuge. They possess a distinct peppery taste and odor, faintly recalling that of allspice. A chemical and microscopical examination of the fruits exhibited in Vienna that had been obtained from Guiana by way of Venezuela was made by T. F. Hanausek, and it established the presence of a volatile oil, a soft resin, tannin, and indifferent bodies. It would seem to be valuable as an aromatic tonic, or a culinary spice. (Zeltschr. d. Oestr., Apoth. Ver., Dec. 10, 1877, p. 571.)

VIOLACEÆ.

Cipo-zumo: *Anchietea salutaris*. Dr. Theodor Peckolt describes this as a useful medical plant frequently met with in Brazil. He claims various purgative and antisyphilitic virtues for it.

FRANKENIACEÆ.

Yerba reuma: *Frankenia grandifolia*, Cham. and Schlecht. The Spanish name, meaning flux herb, implies that this plant is chiefly used in catarrhal affections. Yerba reuma is an erect or prostrate leafy undershrub, 6 to 12 inches high, found on the seashore from San Francisco to San Diego and southward, also eastward in

the desert to Arizona and southern Nevada. It has been subjected to chemical and microscopical examination by Carl Jungh, Ph. D., of Detroit, Mich. (New Preparat., March, 1879, p. 55.) It was found to contain a peculiar astringent principle, and a remarkably large percentage of sodium chloride. Its value as a topical application is largely attributable to this combination. Dr. F. C. Herr gives the results of the use of this drug in a number of cases. (Therap. Gaz., 1883, p. 315.) He employed a fluid extract and a tincture of yerba reuma with marked success in the local treatment of nasal catarrh, gonorrhœa, leucorrhœa, coryza, ozæna, gleet, and chronic inflammations of the mucous membranes in general. He also found the fluid extract of yerba reuma to act admirably as a local application in herpes zoster. (Parke, Davis & Co., Brochure No. 59.)

TAMARISCINEÆ.

Ocotilla: *Fougnieria splendens*. This fan-shaped tall shrub abounds on the table lands of the Mexican boundary line, where it is known by the Mexican name of ocotilla. The bark has been chemically examined by Dr. Helen C. De S. Abbott. A peculiar new wax was obtained, differing in its properties from other known vegetable waxes. The name of ocotilla wax was proposed for this product. A white crystalline substance, a gum resin, and possibly glucosides, were also indicated. (Am. Journ. Pharm., Feb., 1885, 81–85.)

MELIACEÆ.

Cocillaña: *Guarea Rusbyi* (Britton). Out of several hundred native remedies examined by Dr. H. H. Rusby during his explorations in South America, this is the second one that he has so far proposed as meriting the careful attention of the medical profession. The physiological and clinical investigations made with the drug indicate a high remedial value for it. Dr. Rusby discovered cocillaña in 1886 in Bolivia, the drug being the bark of an undetermined species of *Guarea*. Dr. Nathan L. Britton at first erroneously assigned it to the natural order of the *Anacardiaceæ*, and he described it under the name of *Sycocarpus Rusbyi*. Subsequently it was referred with some doubt to *Guarea trichlinoides*, Linn. The tree reaches a height of 30 to 40 feet, with a trunk diameter of nearly 3 feet. It is low and spreading in its habit, somewhat resembling an apple tree in its general looks. The therapeutic properties of cocillaña appear to be those of an expectorant, tonic, and laxative. Its sphere of action and influence is somewhat similar to that of ipecac, but it seems to be superior to the latter in certain diseases of the air passages. Clinical experience has also established the fact that it exerts a tonic influence on the appetite, and that it reduces the night sweats of chronic bronchitis and phthisis. The fluid extract is an eligible preparation administered in doses of 10 to 30 minims. Cocillaña has been the subject of very careful botanical study by Dr. Nathan L. Britton, of Columbia College. (Bulletin of the Torrey Botanical Club, July, 1887.) Joseph Schrenk has published pharmacognostical and microscopical notes on its structure and appearance. (Drug. Bullet., Aug., 1888, p. 222.) Dr. H. H. Rusby has prepared an elaborate account of its physiological action and therapeutic history. (Therap. Gazette, Aug., 1888, p. 518.) Numerous clinical studies of cocillaña have been recorded by Dr. Reynold W. Wilcox and other practitioners. The results of these investigations would seem to warrant the claim that while the action of this drug is in some respects similar to that of ipecac, it is still sufficiently distinct from that, and from all others, to constitute a drug of an entirely new action, one which will not fall into line with any other. (Parke, Davis & Co.'s Brochure No. 17.)

LINEÆ.

Erythroxylon pulchrum, St. Hil. This near relative of the well-known Erythroxylon Coca seems to have received but little attention so far. It is met with abundantly in the mountainous region about Rio de Janeiro. Mr. Theodor Peckolt has experimented with this Brazilian species of Erythroxylon, and has obtained from the fresh leaves a very small percentage of cocaine, a strongly bitter extractive principle, and a crystallizable acid. These leaves would seem to deserve a careful therapeutic study.

SIMARUBEÆ.

Cedron seed: *Simaruba cedron*, Planchon. The cedron tree appears to be confined to the United States of Colombia, ranging from the fifth to the tenth degree of north latitude, and from 75° to 80° of west longitude, but is always rather rare. The drupaceous fruit is about the size of a swan's egg, and has the appearance of an unripe peach. Each drupe contains one seed, the cedron of commerce, which is easily separated into two large cotyledons, resembling blanched almonds, but larger in size, and plano-convex in contour. Leroy, in 1851, discovered a bitter principle in the seeds which he named "cedrine." More recently Tanret has isolated from them an alkaloid of very great activity, cedronine, the dose of which is a milligram. Cedrine was also found to be poisonous in large doses. Cedron seeds have been used extensively by the natives and the physicians of Mexico and Central America. They are so intensely bitter that a fluid or solid extract is generally preferred to the crude drug. The dose of the fluid extract is stated at 1 to 8 minims. The drug is used as a remedy for the bites of insects and serpents; for hydrophobia; it is of service in intermittent fever, dyspeptic affections, cholera morbus, colic, facial neuralgia, and gout. Almost incredible reports have been published of its marvelous effects in the treatment of hydrophobia and the bites of venomous reptiles, such as rattlesnakes, moccasins, copperheads, and tarantulas. It is claimed for cedron that it possesses tonic, antiperiodic, and antispasmodic virtues of so decided and pronounced a character that the drug is fully entitled to a prominent place in the classification of the materia medica of the future. (Parke, Davis & Co.'s Brochure No. 25.)

Cascara amara Picramnia, spec. indet.; also known as Honduras bark. The plant furnishing this bark is indigenous to Mexico, Honduras, etc. It has been chemically examined by F. A. Thompson, who procured an alkaloid from it, for which he suggested the name of picramnine. (Am. Journ. Pharm., 1884, p. 390.) This active principle has the peculiar taste of the bark, and is believed to represent its virtues. Numerous clinical reports on cascara amara tend to confirm its value as an alterative. It is credited with achieving cures of chronic cases of syphilitic eruptions, syphilitic tubercles, chronic eczema, and gummy tumors. Although slow in its action, it is regarded almost as a specific in syphilis. The assertion is made for it that it eliminates the specific poison from the system. The fluid extract is given in doses of one-half to 1 dram and the powdered extract in doses of 5 to 10 grams. An illustration of Honduras bark and a number of clinical reports on it are given in Parke, Davis & Co.'s Brochure No. 12.

ZYGOPHYLLACEÆ.

Creosote wood: Tah-sun-up of the Pah-Ute Indians. *Larrea Mexicana*. It is quite common in southern California, Lower California, Arizona, and southern Utah. An infusion of the plant is used with benefit for open sores on men and animals. The powdered leaves are said to be valuable as an application to chronic sores. A peculiar gummy substance exudes from the old wood in abundance, and is used by the Apaches as a styptic. The peculiar odor of the fresh plant has earned for it the name of creosote wood. (Dr. E. Palmer in Am. Journ. Pharm., Dec., 1878.)

RUTACEÆ.

Xanthoxylum Naranjillo, De Cand., is used in the Argentine Republic as a sudorific and diuretic. Parodi has found a volatile oil and an alkaloid in it. (Am. Journ. Pharm., 1890, p. 177.

Jaborandi.—Two varieties of this valuable drug have received the official recognition of the seventh decennial revision of the United States Pharmacopœia, namely, the leaflets of the *Pilocarpus Selloanus*, Engler (Rio Janeiro jaborandi), and those of *Pilocarpus Jaborandi*, Holmes (Pernambuco Jaborandi). In addition to the drug in its crude form, the new pharmacopœia also recognizes the fluid extract, and the hydrochlorate of the active alkaloid, pilocarpine. Jaborandi is so powerful and so certain in its diaphoretic action that it now ranks as the most reliable and influential remedy of its class. In fact, so great is its power that it has very considerably extended the use of diaphoretics. It has rarely occurred that a new remedy has been so very generally accepted, and so universally introduced in so short a space of time as jaborandi, which was first brought to the notice of the profession in 1874 by Dr. Coutinho, of Pernambuco.

Brazilian Angustura bark—Esenbeckia febrifuga, Mart. The bark of a plant found on the coast range of Brazil. It has been chemically examined by Buchner and by von Karl am Emde. A nitrogenous base, named Esenbeckina, was obtained from it in a crystallized form. The pure alkaloid, as well as its hydrochlorate, were found to be highly deliquescent when exposed to the air. (Arch. Pharm., 193 B., 2 Hft.)

OLACINEÆ.

Muirapuama. *Liriosma ovata*, Miers. Brazilian correspondents of Messrs. Parke, Davis & Co. assure them that this root is more highly esteemed as an aphrodisiac and nerve stimulant in Brazil than damiana is with us. A fluid extract is recommended, in doses of ¼ to 1 dram. (Parke, Davis & Co.'s Brochure No. 47).

ILICINEÆ.

Yerba maté; Cha-maté; Paraguay Tea: *Ilex paraguayensis*, St. Hil. The prepared leaves of this, and most probably also of several other allied species of ilex, form an important article of the daily food of a vast number of the inhabitants of South America. Their therapeutic effect is due chiefly to the caffeine which they contain in relatively large proportion. The infusion of the leaves, used as a beverage in place of tea or coffee, is regarded as an exhilarant, acting as a cerebral stimulant, but inducing indolence and drowsiness subsequently. The usual mode of its preparation consists in pouring boiling water upon the prepared dried leaves. The infusion while still hot is sucked up, frequently from a common bowl, through a silver tube known as a "bombilla." This instrument is furnished at the lower end with a perforated bulb, which prevents the ingress of the coarsely crushed leaves by straining them out.

RHAMNACEÆ.

Zizyphus mistol, Griseb. Indigenous in the Argentine Republic. The fruit is claimed to have diuretic properties.

Piquillin: *Condelia linearia*, Griseb. Also met with in the Argentine Republic. The inspissated juice has been used as a laxative for children.

Quina del Campo: *Discaria longispina*, Miers. A rare Brazilian bush, covered with spines, the roots of which have antifebrile properties.

SAPINDACEÆ.

Timbo: *Paullinia pinnata*, Linn. A Brazilian plant closely related to the well-known tree which furnishes guarana. The bark is the only part of the timbo root used in Brazil. It has an aromatic, agreeable odor, which slightly resembles that of musk. Poultices made from it with boiling water are applied externally for affections of the liver. They often produce so intense an eruption that it becomes necessary to discontinue their use. Mr. Martin has isolated an alkaloid from timbo bark which he has named timbonin. He has also succeeded in crystallizing the sulphate of timbonin in white needles. (Bull. Gén. de Thérap.) Other plants are also known as timbo.

POLYGALACEÆ.

Yallhoy: *Monninia polystachya*. A pretty plant, extensively distributed, growing near the summits of steep mountains in South America, as well as on the wooded plains and marshy districts of the same region. Therapeutic virtues have been attributed to two parts of the plant, the bark of the root and the recent leaves. The latter are regarded as an expectorant, whilst the former is considered to be an astringent. The root is of large size, 16 to 18 inches in length and of yellowish color. Its taste is at first sweetish, but afterwards it becomes acrid, bitter, and exciting the flow of saliva. The infusion is turbid, like soapy water. The drug can be given in the form of powder or infusion in doses of 10 to 12 grams per day. A 25 per cent tincture made with alcohol and ether has also been recommended, as well as an ointment made from the extract of monninia. (Etudos Medicos, No. 4, Practitioner.)

LEGUMINOSÆ.

Resina d'angelim pedra is used in Brazil as a febrifuge. It is believed to be obtained from *Ferreira spectabilis*, and seems to be identical with the so-called rhatanin found by Dr. Emil Ruge in the South American rhatany extract. (Zeitschr. d. oestr. Apoth.-Ver., 1869, 32.)

Araroba (Goa powder).—The tree from which this powder is obtained is known as the *Angelim amargoso*. It is the Andira araroba of Aguiar. The powder furnishes a neutral principle, the chrysarobinum, which is officinal in the United States Pharmacopœia. It is extensively employed in the treatment of cutaneous affections, for which purpose the *Unguentum chrysarobini* has also been adopted in the United States Pharmacopœia.

Chanar: *Gourliea decorticans*, Gill. A drug from the Argentine Republic, where the inspissated juice of the fruit is used in pectoral affections.

Prosopis tintitaco.—Also from the Argentine Republic. The fruit is reputed to have diuretic properties.

Resina de Angico.—A product of the district of Maranham; is misnamed a resin, as it is in reality a gum of deep brownish-red color, translucent, and breaking with a shining fracture. Chirnoviz assigns it to the *Acacia angico*, and claims it to be of value in pectoral complaints. The same tree yields an astringent bark. With twice its weight of water, the gum forms a thick magma. It dissolves in proof spirit almost as well as in water. The aqueous solution is rendered turbid by ammonium oxalate, but it is not affected by ferric chloride, borax, or plumbic acetate. (Yearbook of Pharmacy, 1882.)

Cumanda viray: *Calopogonium cæruleum*, Benth. An herb met with abundantly in the Argentine Republic and other parts of South America, where it is employed as an aperient febrifuge.

Urizuhei: *Rhynchosia diversifolia*, Mich. Used in the Argentine Republic as an expectorant, and as a remedy for spasmodic coughs.

Yerba del toro: *Crotalaria incana*. A common herb of the Argentine Republic, where it is used for making an aromatic tonic tea, which is popularly used for stomach-ache, and also as a perfume.

Mezquite: *Algarobia glandulosa*. The tree yields a gum, which has frequently been used as a substitute for gum arabic. Mezquite leaves have been employed with great success in the treatment of inflamed eyes. They are also of value as a cataplasm for inflamed surfaces. In the form of hot infusion they are given as a febrifuge in mild fevers. The legumes act as simple laxatives; they are also of great value as a food for cattle. The Mexicans prepare a pleasant beverage from them, called "atole." This is simply an infusion made by throwing the crushed ripe berries into boiling water, or by boiling them together, and subsequently straining. A fermented liquor is also made in Mexico from the fruit, which readily undergoes alcoholic fermentation. The decoction of the heartwood of the tree is used in diarrhœa, being a valuable remedy in this and similar complaints. (Am. Journ. Pharm., Feb., 1890, p. 65.)

Panbotano bark.—Prof. Dujardin-Beaumetz calls attention to the panbotano tree of Mexico as a new specific for the fever and other symptoms of paludism. No alkaloid or glucoside has so far been found in the bark. Valude administered an alcoholic tincture and a concentrated decoction, preferring the latter. Seventy grains of the bruised bark were administered in twenty-four hours. In the 8 paludic cases described by Valude a single dose, or at most two doses, was sufficient to cause the disappearance of well-defined tertian fevers. (Nouveaux Rem., Mar. 8, 1890.)

Jamaica dogwood: *Piscidia erythrina*, Linn. The bark of the root is the part employed in medicine. The tree is met with in the West India Islands and on the adjacent mainland. Attention was first called to the drug in 1844 by Dr. William Hamilton, who recommended it as a powerful narcotic, capable of producing sleep and relieving pain to an extraordinary degree. About 1878 it was more carefully worked up as to its physiological action and therapeutic effects by numerous experimenters. It is without doubt a very active drug, but its exact practical value does not yet appear to have been definitely settled. Various practitioners have reported good results from its use as an anodyne in neuralgia, nervous insomnia, whooping cough, etc., but in the hands of others the remedy has failed to be of benefit. The fluid extract seems to be a valuable application for certain forms of toothache. A very elaborate and carefully prepared monograph on Jamaica dogwood has been published by Parke, Davis & Co. in their Brochure No. 25.

ROSACEÆ.

Quillaja: *Quillaja Saponaria*, Molina. Soap bark has found official recognition in the United States pharmacopœia, together with a tincture made from it. The tree is a native of Peru and Chile, where it is known as Quillay, a term derived from the Chilean word quillean, to wash. Saponin, quillaiac acid, and sapotoxin have been isolated from it. At a meeting of German naturalists in Strasburg soap bark was proposed by Dr. Kobert as a substitute for senega root in pulmonary affections. He claimed that quillaja bark does not irritate the gastro-intestinal tract, that it quiets cough, increases the discharge of sputa, and that it is for these reasons even preferable to senega, which statements received general approval. Mr. Dimitry Pachurokow has devoted special attention to the study of the most active constituent of the drug, namely, the sapotoxin. This is present in the bark in only a very minute proportion, but it is exceedingly powerful. It is very remarkable for its peculiar action on the red blood corpuscles, which it dissolves completely, even in a dilution of one part in 10,000. This occurs only when the sapotoxin is introduced directly into the circulation by hypodermic injection. When injected in concentrated solution into an involuntary muscle it diminishes

or even entirely destroys its vitality. In spite of this toxic action, Pachurokow also defends the use of soap bark in place of senega on the grounds that its active constituents are more constantly present, and in nearly five times greater quantity. (Amer. Drugg., Apr., 1888, 72.)

MYRTACEÆ.

Chekan, Chegnen, or Cheken: *Myrtus Cheken*, Molina. The leaves of an evergreen shrub or tree varying from 5 to 25 feet in height, found abundantly in the vicinity of Valparaiso, and also extending into Bolivia. It was introduced from Chile as a remedy of some value in the treatment of chronic catarrhal inflammation of the respiratory mucous lining. Dr. Murrell, of London, specially recommends it for the annoying and intractable winter cough of elderly people. Dr. Dessauer, of the German Hospital of Valparaiso, has obtained valuable results from its use in the purulent form of bronchitis. Other practitioners extol it as a desirable addition to the list of remedies in chronic bronchitis. Dr. F. Weiss, of Leipzig, Germany, obtained 1 per cent of an aromatic volatile oil from the dry cheken leaves. This was the only one of numerous constituents isolated by him that possessed a medical interest. Cheken has long been known and used in Chile in cases requiring an aromatic astringent of considerable power. The fluid extract of the drug seems to be an eligible mode of exhibiting its therapeutic effects. It is given in doses of 1 to 3 fluid drams. (Pharm. Centralhalle, 1882, No. 29.)

Jambul.—The seeds of *Eugenia Jambolana*, Lam. (*Sizygium Jambolanum*, D. C.), a tree native to tropical America, the West Indies, and the East. The bark, leaves, and fruit are used medicinally in India. The dried and powdered kernels of the seeds have been highly recommended as a valuable remedy in diabetes. They contain traces of volatile oil, resin, gallic acid, etc. (Pharm. Journ. and Trans., 1888.)

MELASTOMACEÆ

Sulamita Vitullus? *Melastoma Ackermanni.* A new antineuralgic drug from Colombia. It is said to grow abundantly on the eastern spurs of the Cordilleras. The dried flowers of the plant have been used medicinally. When they were subjected to distillation a heavy essential oil was obtained from them which bore a marked resemblance in its odor to that of methyl salicylate, the chief constituent of the oil of wintergreen. (New Rem., Aug., 1883, 241.)

LYTHRACEÆ.

Icica-peré.—A species of Cuphea, common in the Argentine Republic, where it is used as a purgative, diuretic, and alterative.

PAPAYACEÆ.

Southern papaw.—The Carica Papaya of tropical America is sometimes classified among the *Passifloraceæ*. It has long been known that the unripe peeled papaw fruit has the property of rapidly softening the toughest meat when boiled with it for a short time. In Quito the use of the papaw juice for making meat more tender is quite general. The juice of the unripe fruit is also reported to be a powerful vermifuge. An albuminous digestive principle has been obtained from the fruit and has been named papain. This is now an article of commerce, and bears a resemblance to pepsin. Papain is at present used quite extensively as an internal remedy in dyspepsia and gastric catarrh; also as a local application for the destruction of false membranes, warts, tubercles, walls of old sinuses, and even of epithelioma and tattoo marks. It is neither caustic nor astringent, but it destroys the part to which it is applied by virtue of its power of dissolving the muscular as well as the connective tissue. Jacobi asserts that diphtheritic membranes may be dissolved in a few hours by the hourly application of a mixture of one part papain with two parts each of water and glycerin.

CUCURBITACEÆ.

Tayuya or Tayuia.—A new Brazilian drug, which has been introduced and employed in France. It is probably the root of the *Bryonia Tayuya*, or *Trianosperma Tayuya*. The root is recommended in the treatment of syphilis. In small doses it acts as an emetic, in larger quantities as a drastic. (L'Union Pharm., Oct., 1875.)

Chili Cojote of the Mexicans: *Cucurbita perennis*. These large and long roots, after being macerated in water, are used with good effects in Mexico as an application to hæmorrhoids. (Dr. E. Palmer, Am. Journ. Pharm., Dec., 1878.)

CACTEÆ.

Night-blooming Cereus: *Cirio de flor grande*: *Cereus grandiflorus*, Haworth. Indigenous to the West India Islands. This has been characterized as being the loveliest of all the cactus family. When in full bloom it has been poetically styled the "Queen of the Night." The drug has been highly recommended as a sedative and diuretic, with special application in functional diseases of the heart, accompanied by irregularity of its action. Benefit has also been derived from its use in palpitation, rheumatism, valvular disease, and dropsy. The alcoholic tincture is most frequently employed. Notwithstanding the numerous clinical reports in which the virtues of night-blooming cereus are lauded, some careful investigators have been unable to observe any effects from it. (Parke, Davis & Co.'s Brochure No. 14.)

TURNERACEÆ.

Damiana: *Turnera microphylla*, D. C.: *Turnera aphrodisiaca*, L. F. Ward. A small mint-like herb, bearing a yellowish-white fragrant flower, growing near the western coast of Mexico. This is claimed to be a powerful aphrodisic, useful in cases of sexual atony. The natives are said to have made use of it for a long time as a stimulant to the sexual apparatus. Cholagogue, cathartic, and emmenagogue properties are also attributed to it. The published reports on the drug vary greatly as to its merits, some experimenters having had great success with it, while others reject it as being utterly useless. Some of these failures may be attributable to the frequent substitution of the leaves of *Haplopappus discoideus*, D. C., and *Bigelovia veneta*, Gray, for the true damiana. As early as 1699 the Spanish missionary Juan Maria de Salvatierra relates in his chronicles that the native Mexicans were in the habit of using damiana for impotency. An elaborate résumé of the literature of damiana has been published by Parke, Davis & Co. in their Brochure No. 23.

UMBELLIFERÆ.

Osha root.—This Mexican umbelliferous root of unknown origin has been chemically examined by Hermann Haupt, jr. He obtained from it a resin, a fixed and a volatile oil, and an aromatic acid, resembling angelic acid. As it presented points of distinction from the latter, the name of oshaic acid was proposed for it.

RUBIACEÆ.

Trompetilla.—The stem and branches of the Rouvardia triphylla, indigenous to Mexico, where it enjoys a reputation for the prevention and treatment of hydrophobia. A description of the drug has been published by Prof. John M. Maisch in the American Journal of Pharmacy for February, 1874.

Cangai: *Relbunium hirtum*, Schumacher. An herb found in abundance in the Argentine Republic, where it is used in the treatment of acute rheumatism.

COMPOSITÆ.

Eupatorium Ayapana, Ventenat. This very aromatic Brazilian composite has a coumarin-like odor, with a slightly bitter and astringent taste. L'Heritier and Martius report that it is used in Brazil as an antidote for snake bites, both internally and as an external fomentation. The leaves are also recommended for indigestion, pectoral affections, and cholera. They appear to have been used in Europe for similar purposes in the early part of the present century. (Am. Journ. Pharm., Mar., 1877.)

Guaco.—Robert B. White, of Salada, New Grenada, claims that Mikania Guaco furnishes the guaco of commerce. Other observers insist that the true origin of guaco has not yet been definitely determined, as quite a number of species of *Mikania*, *Eupatorium*, and *Aristolochia* are indifferently known as guaco in Mexico and Central America. The root is regarded as a specific in rheumatic affections in Mexico, a fluid extract of it being used both internally and externally. The pain and stiffness are said to be often relieved by a single application of the preparation, provided that the parts are kept well covered with it all night. Mr. Robert B. White, who has lived in Choco and other snake-infested regions for many years, testifies that guaco leaves, properly and promptly administered, are a cure for the bites of the most venomous serpents of that country. (Pharm. Journ. Trans., Nov., 1880.)

Topas aire (botanical name not known) is used in the Argentine Republic in the treatment of ophthalmia.

Nio, probably identical with mio-mio, from *Baccharis cordifolia*, Lam. This shrub is a deadly poison to cattle. According to P. N. Arata, it contains an alkaloid, baccarine. The plant is indigenous to the Argentine Republic. (Zeitschr. d. Oestr. Apoth.-Ver., 1881, No. 27.

Raiz del Pipitzahuac: *Perezia Dugesii*. The root of this plant has been used for a long time in northern Mexico as a powerful laxative. This action was found by Prof. Rio de la Liza to be due to a peculiar acid, which he named pipitzahoic acid. Dr. Weld determined its ultimate composition to be $C_{30}H_{20}O_6$. The same acid has also been obtained from Perezia Wrightii, Gr., and from Perezia nana, Gr. (Am. Journ. Phar., Apr., 1884.)

Parthenium hysterophorus is much esteemed in the Antilles as a substitute for quinine. It is found in waste places throughout tropical and subtropical America. It is characterized by extreme bitterness, due to the presence of a glucoside, which has been called "parthenine." Dr. Torar has found the drug to be decidedly efficacious for neuralgia, both intermittent and non-intermittent, especially for the cranial form, but to be utterly without effect as an antipyretic. (Gaz. Médic., May 29, 1886.)

Mutisia viciæfolia, Cavanilles. Dr. Saco, of Bolivia, reports this plant to enjoy the reputation of curing phthisis and all pulmonary diseases. The plant is indigenous to the western part of South America from Chile to Peru. It belongs to the labiatifloral compositæ, which are confined chiefly to South America. (Journ. d'Hygiène, 1886.)

Haplopappus Baylahuen, C. Gay. Used in the province of Coquimbo as an antihysteric remedy, and in veterinary practice in the treatment of wounds. The plant has been found to contain a volatile oil, a fatty oil having the odor of the plant, a brown resin of sharp taste, and tannin. The taste of the drug is said to resemble that of pichi. (Drug. Bull., 1890.)

Zinco or Chinchilla: *Tagetes glandulifera*, Schrk. A native of the Argentine Republic, but not found very plentifully there. It is reputed to have tonic properties.

Carqueza: *Baccharis articulata*. Found abundantly in the same country. Said to be useful for indigestion, sterility, etc.

Yerba mercurial: *Senecio albicaulis.* Also an Argentine herb. It possesses the properties of an alterative, diaphoretic, febrifuge, and expectorant.

LOBELIACEÆ.

Vegetable Kermes: *Lobelia Delisseana.* Dr. Crescentio Garcia claims the therapeutic virtues of this Mexican lobelia to be superior to those of the Lobelia inflata. The name of vegetable kermes has been bestowed upon it on account of a fancied similarity in its action to that of antimony. It has been used for twenty years by several practitioners of Guadalajara in the form of tincture. Excellent results have been obtained from its employment in nervous affections of the chest, and in severe cough and asthma. Dr. Garcia has himself used it with great success in bronchitis, asthma, whooping cough, and particularly in pneumonia. The root is without odor, but when pulverized it is sternutatory. When chewed it is at first sweetish, but this soon changes to a bitter sickly taste. (La Voz de Hipocrates, Apr., 1886.)

ERICACEÆ.

Manzanita: *Arctostaphylos tomentosa*, or *A. glauca*, Lindl. The fruit of this shrub, which is produced in clusters, resembles a small apple, whence the name from manzana, the Spanish word for apple. It has an agreeable taste, and is therefore largely consumed by the Mexicans and Indians, both in the ripe and in the unripe state. Manzanita leaves are regarded as an astringent tonic, with special action on the urinary organs. They have been highly recommended in the treatment of gleet, vesical catarrh, incontinence of urine, etc. Dr. H. W. Rand thinks that these leaves may be advantageously used during the stationary or decreasing stage of gonorrhœa and in long-standing gleet, when the older drugs have failed or have disturbed the stomach. (Parke, Davis & Co.'s Brochure, No. 44.)

PLUMBAGINEÆ.

Guayacuru.—The root of *Statice Brasiliensis*, Boissier. Found in the Argentine Republic. Baycuru root is sometimes confounded with it, but, according to E. M. Holmes, the latter is derived from an entirely different plant, which has not yet been identified. The natives have unlimited faith in the astringent and absorbent virtues of both of these roots, which they employ freely in the form of fomentation or vapor for all kinds of glandular swellings and enlargements. Dr. Landul has sometimes found the drug to fail utterly, but as a rule he believes it to be reliable, both externally and internally, and to be particularly valuable as a gargle. The taste of the drug is astringent, slightly salty, and fishy. (Dr. Charles Symes, in Pharm. Journ. and Trans.)

SAPOTACEÆ.

Lucuma littoralis, Mart. The fruit of this Brazilian plant has a sweetish, unpleasant, and astringent taste. Dr. Peckolt states that in Brazil it is used as a remedy for chronic diarrhœa.

Lucuma mammosa, Gärtner. Also found in Brazil. The fruit is eaten as a dessert, a little lemon juice being added to correct its insipidity. The seeds, which contain 25 per cent of a bland, fixed oil of pleasant flavor and odor, are used in kidney complaints. The bitter bark is used in intermittent fever in teaspoonful doses of a 20 per cent tincture.

Lucuma obovata, H. B. Kth. The fruit of this Brazilian species has a very pleasant, creamy taste. The seeds are roasted and used as a beverage. The decoction and emulsion of the raw seeds are used in the treatment of catarrh of the bladder.

Lucuma rivivoca, Gärtner. This fruit has a mucilaginous, agreeable, sweetish pulp, and constitutes a popular dessert. It is used medicinally in the form of confection and syrup in the treatment of dysentery and catarrh of the lung. The emulsion of the seeds is a popular diuretic.

Lucuma torta, Mart. A syrup is made from the edible fruit, which is used in bronchitis, catarrh, and affections of the lungs.

Lucuma psammophila, A. D. C. The agreeable, sweet fruit is regarded as a delicacy, and is used in the preparation of a confection. The bark enjoys the reputation of being a tonic.

Lucuma glycophlœa, Mart. et Eichl. This may be viewed as the most important of the group, as it is the source of the commercial extract introduced from Brazil under the name of monesia. The bark of this tree was imported into Europe as early as 1555, and it is the part which is now principally exported. Dr. Peckolt has succeeded in crystallizing monesin from it. (Pharm. Rundschau, Jan. and Feb., 1888.)

APOCYNACEÆ.

Thevetia neriifolia. Indigenous to the West Indies, New Granada, and Peru. The bark and the seeds of this tree are regarded as a powerful febrifuge. According to De Ury, the seeds contain 75 per cent of an almost colorless fixed oil, and a crystallizable glucoside, thevetine, which can be split up into glucose and theveresin. (Journ. de Ph. et Chim., Mai, 1869.)

Thevetia yccotti, D. C. Joyote. Found in the damp, hot regions of the fertile mountains of the great Mexican Cordillera. The Aztecs believed the seeds to cure the bite of the rattlesnake. The ancient Mexicans made use of the milky juice of the tree for curing deafness and cutaneous eruptions. They applied the leaves topically for toothache and as an emollient and resolvent to tumors. The fruit was used by them for healing ulcers. At present the fruit is called in Mexico "huesos ò codos de fraile," bones or friar's elbow, from its resemblance to the human elbow. The seeds have a high reputation among the people in hæmorrhoids. They are first triturated, then mixed with suet, and applied locally. Prof. Alfonso Herrera obtained a well-defined glucoside from the seeds, which he named thevetosin. Physiological experiments made by Luis Hidalgo Carpia with thevetosin proved it to be very venomous, acting as a powerful emetic and paralyzing the respiratory organs, and possibly also the general muscular system. (Am. Journ. Pharm., Apr., 1877.)

Pao-Pereira: *Geissospermum laeve*, Bouillon; *Picramnia ciliata*, *Vallesia punctata*, *Tabernæmontana lævis*, *Geissospermum vellosii*. A tree native to Brazil. An alkaloid was discovered in it in 1838 by Santos, and named pereirine. About 1830 Prof. Silva made known the febrifuge and antiperiodic properties of the bark. The alkaloid, which is now sometimes called geissospermun, is used in Brazil in an impure form. It occurs there as a brownish yellow, amorphous mass of extremely bitter taste. (Compt. Rend.)

Quebracho.—The bark of *Aspidosperma quebracho-blanco*, Schlecht. An evergreen tree, 14 to 20 meters high, growing in the Argentine Republic, in northeastern Bolivia, northern Patagonia, and southwestern Brazil. The same name seems to be also applied to *Quebrachio morongii*, Britton, *N. O. Terebinthaceæ*, which is known to the natives as quebracho colorado, and is used largely for tanning purposes. Quebracho has been introduced as a sovereign remedy in dyspnœa. It relieves the cyanosis and the sense of suffocation due to embarrassed respiration, as in emphysema, capillary bronchitis, phthisis, and chronic pneumonic processes, and in asthma. It appears to assist in the oxygenation of the blood, and at the same time to stimulate the respiratory centers. Quebracho bark is said to contain at least six different alkaloids, the most important of these being aspidospermine, quebrachine, hypoquebrachine, and aspidosamine. The com-

mercial aspidospermine seems to be a mixture of all of the six alkaloids, so that it fairly well represents the activity of the drug. It is probably the most valuable remedy known for dyspnœa in its various forms. The dose of it is given at one-fourth to one-half grain. The crude drug and its corresponding fluid extract have of late become sufficiently popular to warrant their recognition by the new United States pharmacopœia of 1890, which has bestowed the official title of aspidosperma upon the remedy.

Guachamaca: *Malonetia nitida*. According to Dr. Schiffer, an aqueous extract of this Venezuelan plant is reputed to have wonderful effects in allaying convulsions of the motor apparatus. It contains an alkaloid, guachamacine, soluble in water, which in its physiological action resembles curarine. Dr. Schiffer believes that this remedy may be found to be valuable in diseases involving an exaggerated action in the motor apparatus, and possibly also as a general hypnotic. (New Rem., Aug., 1882, 231.)

Yalapa: *Echites longiflora*. A plant of the Argentine Republic, where it is used as a purgative. In the powdered form it is also employed in plasters. (Amer. Drugg., Nov., 1889.)

ASCLEPIADACEÆ.

Condurango: *Gonolobus condurango*, Triana. In 1871 the Government of Ecuador forwarded some of this drug to the State Department at Washington, with a request that it be analyzed and tested as to its medicinal value. The parcel was accompanied by testimonials of Drs. Cæsares and Eguiguren, of the Province of Loja, attributing great medicinal virtues to the drug in the treatment of cancer fungus hæmatodes, and constitutional syphilis. The drug was subsequently introduced into this country in a manner calculated to prejudice the medical profession against it, so that there has been a disinclination here to give it a fair trial. It has been much more carefully and persistently experimented with in Germany, where numerous reports on it have been published. Dr. Wilhelmy, in the Berl. Klin. Wochenscrift, claims that the pains of patients having cancer of the stomach became materially reduced by the use of condurango. The appetite was improved, the painful vomiting was diminished, and an increase of weight took place. Though all of his patients died except one, he concludes that the drug afforded them material relief, and he feels encouraged to make further trials with it. Condurango was even made official in the second edition of the Pharmacopœia Germanica. A most exhaustive treatise on the therapeutic action of condurango has been published by Dr. L. Riess, in the Berl. Klin. Wochensch., No. 10, 1887. It has been translated and published in Parke, Davis & Co.'s Brochure No. 18.

CONVOLVULACEÆ.

Cabello de Ángel, Ieipo Chumb.—A species of Cuscuta or dodder, a parasitical plant of the Argentine Republic. It is regarded there as a gentle laxative, diuretic, and antiphlogistic. It is used in the form of an infusion for intermittent fevers and for congestion of the respiratory organs. Also, as a decoction in cases of hæmoptysis, inflammation of the throat, and for internal abscesses. The plant is somewhat rare in its native country. (Brit. and Colon. Drugg.)

SOLANACEÆ.

Braço de Preguiça, or Velame: *Solanum jubatum*, Dunal. A Brazilian drug, consisting of large, brittle leaves of papery texture, about a foot long by 9 inches wide. Dr. Barnsley states that the leaves and root of this plant are used as antisyphilitics in the form of infusion or extract. According to Martius, the drug is used as a resolvent in congestion of the bowels, and as an external application for cleansing and healing wounds and ulcers. (Ph. Journ. Trans., May 15, 1875.)

Duraznillo: *Cestrum pseudoquina*, Mart. The leaves and root bark are employed in fevers and abdominal complaints in the Argentine Republic.

Pichi: *Fabiana imbricata*, R. et P. Indigenous to Chile. A plant with plume-like sprays of light, bluish-green color, growing on high, dry hilltops. Its appearance resembles that of a conifer very much more than that of a solanaceous plant. Its medical properties are diuretic, tereointhinate, and tonic. Pichi is very highly recommended in acute or chronic vesical catarrh, when following a mechanical cause, such as gravel or a uric-acid diathesis. It seems to induce the expulsion of the gravel and of those calculi that can be passed through the urethra, and to modify or cure chronic purulent secretions. It is also useful in icterus, dropsy, and dyspepsia due to biliary secretions, but it is contra-indicated where there is organic kidney disease. The fluid extract of pichi is given in doses of 10 to 40 minims, the solid extract in doses of 2 to 10 grains. Dr. Lyons announced a bitter alkaloid of pichi which he named "fabianine." Messrs. Nivière and Liotard were unable to find any trace of such an alkaloid. They attribute the therapeutic effects to a crystalline, fluorescent glucoside, and this statement has since been confirmed by Messrs. Trimble and Schroeter. Pichi is one of the most important of the new drugs secured by Dr. H. H. Rusby in his South American explorations. A very full report on the literature of this valuable drug has been published by Parke, Davis & Co. in their Brochure No. 49. The plant is also illustrated in the Proceedings of the American Pharmaceutical Association for 1886, page 395.

Manaca, Mercurio vegetal: *Brunfelsia Hopeana*, Benth.; *Franciscea uniflora*, Pohl. Indigenous to Brazil and the greater portion of equatorial America. The Brazilian Indians use manaca for rheumatism and syphilis, taking the scraped root bark in half a tumblerful of rum. Manaca may be regarded as a powerful alterative, valuable as an antisyphilitic, antiarthritic purgative, and diuretic. The fluid extract is given in doses of 10 to 60 minims. Prof. G. Dragendorff, of the Imperial University at Dorpat in Russia, has discovered a very energetic alkaloid in manaca. A number of highly interesting reports on the chemical composition, natural history, physiological action and therapeutic properties of manaca have been collated and published in Parke, Davis & Co's. Brochure No. 44. The plant has sometimes been classified among the *Scrophulariaceæ*.

OROBANCHACEÆ.

Crescentia Cuyete, L. The fruit of this plant is used extensively by the Indians of tropical South America. The pulp is valued medicinally as a laxative. Mr. Gustav Peckolt prepared an alcoholic extract of it, which he found to be effective as a gentle laxative in doses of a decigram, while half a gram produced a decidedly drastic effect, without, however, causing pain or inconvenience. The pulp, boiled with water until a black, pasty mass is produced, is applied in the form of a plaster for erysipelas. (Pharm. Rundschau, Aug., 1884.)

GESNERIACEÆ.

Martinia monteridensis, Cham. The seeds of this plant are used in the Argentine Republic for diseases of the eye. (Am. Journ. Pharm., March, 1882.)

BIGNONIACEÆ.

Ipé assú, Paú semto: *Tecomia Ipé*, Mart. Indigenous to some of the Brazilian provinces. A decoction of the wood is used in the treatment of the various forms of scabies. A decoction of the bark is employed both internally and externally in the treatment of herpetic affections and as a gargle for angina tonsillaris. The juice and infusion of the leaves are made use of in various ophthalmic affections. As the wood is often substituted for guaiacum, it was examined chemically by

Dr. Th. Peckolt, who found it to contain a large percentage of chrysophanic acid. (Zeitschr. d. Oestr. Apoth.-Ver., 1873, p. 549.)

Caroba. The leaves of *Jacaranda procera*, Sprengel. A plant indigenous to Brazil. Caroba leaves are inodorous, but they have a bitter and astringent taste. It is claimed for them that they possess alterative, diuretic, sudorific, and tonic properties to a marked degree, on account of which they have great value in the treatment of syphilis in all its forms. When there is much pain in the limbs it is advised to combine potassium iodide with them. In old syphilitic ulcers caroba leaves are recommended topically as well as internally. Their use has also been suggested in other obstinate cutaneous affections. The fluid extract of the leaves is an eligible preparation, which may be given in doses of one-fourth to 1 fluid-dram. Dr. Ottokar Alt, of Hamburg, fully confirms the value of this drug for old syphilitic eruptions. Camillo Weber, during sixteen years' residence in Brazil and other parts of South America, has seen the caroba leaves employed frequently by the resident physicians in the treatment of syphilis, and with the happiest results. Dr. Peckolt claims to have extracted an alkaloid from the leaves, which he names carobine. This also has been found to be efficacious in syphilitic and scrofulous affections. (Parke, Davis & Co.'s Brochure No. 11.)

Jacaranda lancifolia.—A plant from the United States of Colombia which has been experimented with by Drs. Murray Smith, Alfred Wright, and Z. Mennell. The leaves were found to be very useful in cases of gonorrhœa, syphilis, and in vesical affections attended with purulent urine. Prof. John M. Maisch, however, believes the plant to be identical with the *Jacaranda procera* noted above.

Cinco folhas: *Sparattosperma Leucantha*, Mart. Dr. Theodor Peckolt advocates the introduction of the leaves of this handsome, tall Brazilian tree into European medicine. The leaves of the sparattosperma have powerful diuretic properties; they are also extensively used for diseases of the spleen and liver. They are administered in the form of infusion, tincture, or alcoholic extract. Dr. Peckolt has obtained from them 2.8 per cent of sparattospermin, which was found to be a neutral substance and not a glucoside. In its composition it approached very closely to phloridzin. Dr. Peckolt found it to be a diuretic in doses of 1 to 2 grains. (Zeistchr. d. Oestr. Apothek.-Ver., Aug. 10, 1878.)

VERBENACEÆ.

Lippia Mexicana.—The plant is indigenous to moist places in southern Mexico. The leaves have an agreeable taste, which has been compared to that of the lemon balm. Other observers call the odor pungent, and are reminded by it of pennyroyal and camphor. Dr. Podwissotzki, of Dorpat, Russia, has examined the leaves and has obtained from them tannin, a volatile oil, and a camphor-like body, which he named lippiol. Prof. John M. Maisch is of the opinion that Dr. Podwissotzki's researches have reference to the *Cedronella Mexicana*, Bentham, which has been admitted into the Mexican pharmacopœia under the name of toronjil. The constituents of *Lippia Mexicana* are free from toxic properties. The therapeutic virtues have been studied by Saxton, Durant, Blasdale, and Blackerby. The drug appears to be a good expectorant, useful for reducing the irritable condition of the mucous membranes of the organs of respiration. It has rendered excellent service in acute and chronic bronchitis, and in bronchial affections complicated by serious irritation. (Parke, Davis & Co.'s Working Bulletin on the Drug.)

Lippia graveolens, Kauth, and *Lippia dulcis*, Treviranus, called in Mexico "yerba dulce." These are there used in the form of infusion for their demulcent, pectoral, and emmenagogue properties. The yerba dulce has been subjected to a proximate analysis by Rio de la Loza. (Amer. Journ. Pharm., 1885, p. 330.)

Yerbon o Menstruz: *Stachytarpha dichotoma*. Used by the natives of the Argentine Republic as a tonic, and in bronchitis, coughs, convulsions, colic, paralysis, contusions, etc. (British and Colon. Druggist.)

LABIATÆ.

Yerba buena: *Micromeria Douglasii*, Berth. Found on the Pacific coast of North America. This has long been a favorite medicine among the Mexican population. It is a grateful aromatic stimulant, and is useful as a carminative and anthelmintic. It allays nausea and spasmodic pains of the stomach and bowels, and reduces the force and frequency of the pulse. Yerba buena is also an excellent anthelmintic, well adapted for the expulsion of round worms from children. The dose of the fluid extract is from one-half to two fluid drams. When freshly gathered the herb has a grateful perfume, peculiarly sweet and aromatic. When dry its strong scent recalls that of a mixture of peppermint and camphor; by others its odor is compared to that of pennyroyal. When chewed it excites a moderate flow of saliva, which it tinges to a deep-green color. It produces an aromatic, pungent, slightly bitter, and camphoraceous taste in the mouth. Dr. E. Palmer states that the Western Indians use a tea prepared from it for fevers and colds. (Amer. Journ. Pharm., Dec., 1878; Parke, Davis & Co.'s Brochure No. 58.)

Albochaca: *Ocymum basilicum*. The fresh juice of this labiate is used as an efficient anthelmintic in Buenos Ayres. Worms in every stage of their development rapidly leave their location after the juice reaches them. No injury results from the administration of the juice, whether worms are present or not, the medicine acting as a laxative and disinfectant. Fifty grams of the juice are given, followed in two hours by a dose of castor oil. If any worms were present there is soon a free discharge of them. (Gaillard's Med. Journ., Mar., 1880.)

Chia: *Salvia chian*, La Llave; *Salvia Hispanica*. This labiate is met with very abundantly in the northern States of Mexico. The seeds abound in mucilage and fixed oil, being in this respect similar to flaxseed. They are highly valued for the preparation of a refreshing drink for the sick. This is made by macerating a tablespoonful of the seeds in a tumblerful of cold water for half an hour, then sweetening and flavoring it with orange-flower water. This drink is very efficient in fevers, when great thirst usually distresses the patient. As a demulcent and emollient the seeds are superior to flaxseed. The mucilage prepared from them is often used advantageously as a vehicle for mild injections in the earlier stages of venereal diseases. It is also very useful as a gargle and wash in throat affections. Chia seeds are small in size, about one-sixteenth of an inch in length and one twenty-fourth of an inch in width. They are oblong-ovate, somewhat flattish, smooth, and glossy. When immersed in water they readily yield their mucilage to it, swelling to about twice their natural size. They are inodorous when whole, but when crushed they have an oily smell similar to that of ground flaxseed. *Salvia chian* is quoted in the Farmacopea Mexicana as a new species. Dr. Edward Palmer claims that *Salvia Columbariæ*, Benth. is the "chia" of the Mexicans and Indians of Arizona and New Mexico. Prof. John M. Maisch concludes that at least several species of Salvia have fruits resembling very small ricinus seeds, and that the generic name of chia is indiscriminately applied to all the fruits of salvias that have mucilaginous characters. (Amer. Journ. Pharm., May, 1882.)

Ovechá-caá—The common people of the Argentine Republic apply this title to several species of Hytis, which are there met with rather frequently, and which are used in the treatment of syphilis. (Brit. and Colon. Drugg.)

CHENOPODIACEÆ.

Chenopodium quinoa—The seeds of this plant contain nearly 40 per cent of starch. They have been used for many years as an article of food in Chile and Peru. Mr. M. C. Cooke describes a bitter seeded variety, known locally as "amargo," which is there cultivated in gardens and used medicinally. These

seeds are applied to sores and burns in the form of decoction or cataplasm. They are also given internally as a substitute for quinine. Their bitterness seems to be confined to the husks, or testa of the seeds. It may be removed by digestion in dilute solution of sodium carbonate, and subsequent washing. (Am. Journ. Pharm., 1872, p. 557.)

Herba Santa Maria of Brazil is the familiar *Chenopodium ambrosioides*, L., where it is also known under the names of matruz, mentruz, and mastruco, although these same terms are occasionally bestowed also on several other plants. The tops of the herb are employed in Brazil as an efficient vermifuge, when made into an electuary with castor oil. (Ph. J. Trans., Mar., 1879.)

Yerba de Santa Maria, or Caané, are the popular names in the Argentine Republic for the *Chenopodium anthelminticum*. It is there used for hysterical fits, indigestion, catarrh of the stomach, dysentery, pleurisy, asthma, and particularly for paralysis of the tongue. (Amer. Drugg., Nov., 1889.)

PHYTOLACCACEÆ.

Pipi root: *Petiveria hexaglochin*, Fischer. The genus is confined to tropical America. Richard refers pipi root to *Petiveria alliacea*, Linn., and Martius to *Petiveria tetrandra*, Gomez. Pipi root attracted attention in Europe about sixty five years ago, and its investigation has lately been resuscitated. The root is recommended as an emmenagogue. It has also been used internally and in fomentations as a diaphoretic, stimulant, expectorant, anthelmintic, and in fevers, tooth ache, and gonorrhœa. (Am. Journ. Pharm., Aug., 1887.)

Guiné ô pipi is the name applied in the Argentine Republic to the *Petiveria alliacea*, where the root is used as a febrifuge and in the treatment of rheumatism, hydrophobia, snake-bites, etc. (British and Colon. Drugg.)

POLYGONACEÆ.

Raiz del Indico: *Rumex hymenosepalum*, Torrey. A name applied by the natives of Mexico to a plant growing abundantly along the Rio Grande, the root of which is used by them as an astringent. Several of these fleshy and fusiform roots grow together from a short head. They are nearly circular, 1 or 2 inches in diameter and from 2 to 6 inches long. On chemical examination they were found to contain chrysophanic acid, aporetin, phæoretin, and several non-important principles, with about 23 per cent of tannin. Prof. Henry Trimble reports more recently that this root is now largely used in tanning, under the name of canaigre, on account of the large proportion of tannic acid which it contains. (Amer. Journ. of Pharm., Feb., 1876, and Aug., 1889.)

ARISTOLOCHIACEÆ.

Milhomen, Jarra, Jarrinha: *Aristolochia cymbifera*, Mart. This Brazilian root consists of pieces about 4 inches long, having a camphoraceous taste resembling that of serpentaria, and also a bitter, pungent taste. The medical properties are analogous to those of serpentaria. This root has been repeatedly tried in Europe during the last century, and has lately again appeared in the European drug markets. It does not appear to be superior to other well-known remedies of similar character. (Chem. Zeit., 1887, 379.)

PIPERACEÆ.

Yatebû-caá, the common name of several species of peperomia, which are met with in abundance in the Argentine Republic, where they are used as febrifuges and tonics. (Brit. and Colon. Drugg.)

Yerba mansa, or yerba del manza (mild herb): *Houttuynia Californica*, B. & H.; *Anemopsis Californica*, Hooker; *Anemia Californica*, Nutt. An herb indigenous to California and northern Mexico, where it is used as a stimulant and tonic. The natives employ it in malarial fevers, particularly in the chronic forms. In diarrhœa and dysentery it is a remedy of pronounced value. The fluid extract is given in doses of 15 to 60 minims. The general appearance of the growing plant is very much like that of the common plantain, but the leaves are smaller and more prostrate. It presents indeed so handsome an appearance that it has been recommended for ornamental purposes. Dr. H. H. Rusby relates that the natives and settlers whom he met with in his travels extolled the drug as an excellent stomachic, and that they also attributed alterative and anti-rheumatic properties to it. Occasionally they used the plant as a stimulating application to open wounds and to swellings. Prof. J. T. Rothrock regards it as a diuretic and as being of service in the form of baths for rheumatic affections. He looks upon it as a promising plant for future investigation, and he anticipates that in a general way it will be found to be similar to the ava kava root in its therapeutic effects. Dr. George states that the native Spanish population look upon yerba mansa as a panacea. In his vicinity it is used in gonorrhœa and in the same classes of urinary difficulties in which cubebs are available. As an anti-emetic he administered one or two drops of the fluid extract in a teaspoonful of water with good effect. It is stated that the knowledge of the remedial virtues of this plant was preserved as a secret of great value by the natives for a very long time. Mr. J. U. Lloyd obtained a large proportion of a volatile oil from the drug, to the presence of which he attributes its strong piperaceous odor and taste. (Parke, Davis & Co.'s Brochure No. 58; Am. Journ. of Pharm., Jan., 1880.)

Jambu assu.—The root of *Piper jaborandi*, Vell.; *Serronia jaborandi*, Gandie et Guillemm; *Ottonia anisatum*, Spreng.; *Ottonia jaborandi*, Kunth. This plant is called "jaborandi," in common with many others which are employed in popular medicine, as sudorifics, diuretics, and febrifuges in Brazil, where it is indigenous. Jambu assu is believed to have a specific action on the uterus, and it is employed for the relief of painful affections of that organ. The opinion seems to prevail that in sufficient dose the drug is capable of inducing abortion. (Parke, Davis & Co.'s Brochure No. 36.)

LAURACEÆ.

Laurel blanco, or Canela molle.—The leaves of the *Ocotea* (*Strychnodaphne*) *suaveolens*, indigenous to the Argentine Republic, are recommended for their diuretic, carminative and emmenagogue properties. (Amer. Drugg., Nov., 1889.)

EUPHORBIACEÆ.

Anda-assu, Indayuçu, Fructu da Amara, Purga de Gentio.—The fixed oil, expressed from the seeds of the *Anda Brasiliensis*, Radde; *Johannesia princeps*, Velloz. This tree is indigenous to Brazil. When its bark is incised a milky juice exudes, which is used for poisoning or stupefying fish. The fruit is over 3 inches in diameter, and contains about 50 seeds. A clear, reddish, fixed oil is obtained from them by expression. Dr. Norris has tried this at the Pennsylvania Hospital, and he found it to be a prompt purgative in doses of 50 minims. It produces neither nausea, vomiting, nor irritation of the stomach or intestines. Compared with castor oil, it is equally active in smaller doses, it is more liquid, and it is free from the disagreeable odor of the latter (Am. Journ. Pharm., Oct., 1881.)

Alveloz.—The milky juice of the *Euphorbia heterodoxa*, Müll., indigenous to Brazil. It was sent by the American consul at Pernambuco to the State Department at Washington with the statement that several cases of cancer had been healed by its external application. A portion of the drug was given by the Sur

geon-General to Dr. Smith Townsend for trial in a case of lupus of the nose of nearly forty years' standing. The ulcer, which had resisted all previous treatment, was healed in a few days by the application of alveloz. The action of the juice is irritating, causing local inflammation. It exhibits the combined action of a caustic and of papine. In cancroid ulceration it promptly destroys the affected tissues layer by layer. A profuse suppuration follows its application to a granular surface. Dr. Clement Ferreire, of Rezende, Brazil, thinks it is destined to play a considerable rôle in the therapeutics of cancroid and syphilitic ulcers. (Proceed. of the Amer. Pharmac. Associat., 1885; Parke, Davis & Co.'s Brochure No. 3.)

Euphorbia pilulifera, Linn.—This plant has long been used in tropical countries in the treatment of asthma, bronchitis, and cardiac dyspnœa. The dose of the fluid extract is from 30 to 50 minims. The drug has been analyzed by Charles G. Levison, Ph. G., of San Francisco, Cal. Dr. C. C. Baker, of New Mexico, has used the plant in two cases of asthma with prompt and satisfactory results. As far as he was able to judge from the sensible effects, however, the virtues of the plant are probably not superior to those of the closely allied indigenous weeds, *Euphorbia maculata* and *Euphorbia hypericifolia*. (Therap. Gazette, Jan., 1884.)

Pallillo. Croton morifolius.—This Mexican plant has been experimented with in France by Messrs. Dugees and Armendaris. Two or three drops of the oil expressed from the seeds acted similarly to a moderate dose of castor oil. The Mexicans use an infusion of the leaves of this plant as a remedy for gastralgia and atony of the stomach. The tincture is of benefit in facial neuralgia, either used as a liniment or dropped into the ear, or taken in 10 to 15 drop doses with orange flower water. (Am. Journ. Pharm., 1884, 476.)

Velamen: *Julocroton Montevidensis*, Klotz. An herb somewhat rare in the Argentine Republic, where it is prescribed in cases of syphilis and syphilitic rheumatism. (Amer. Drugg., Nov., 1889.)

Jatropha macrorhiza, Benth. A Mexican plant, said to resemble podophyllum in its action. Dr. A. H. Noon, of Oro Blanco, Pima County, Ariz., recommends it as a new hydragogue cathartic, with cholagogue and other properties worthy of investigation by the medical profession. (Med. World, Oct. 1889, p. 421.)

Balsamo.—The latex obtained by incisions into the *Jatropha multifida*. This is a popular vulnerary employed in Brazil for wounds. An infusion of the seeds of this Brazilian plant, or the fixed oil obtained from them, is used as a purgative. The dose of the oil is 10 to 15 drops. (Rev. Pharm. de Rio de Janeiro, 1886.)

URTICACEÆ.

Celtis Tala, Gill. A tree found in the Argentine Republic. In infusion is used there in pectoral catarrhs. (Zeitschr. d. oestr. Apoth. Ver., 1881.)

PALMACEÆ.

Carnaüba root, Carnahuba: *Copernicia cerifera*, Martius; *Corypha cerifera*, Arruda da Camara. This species of fan palm is indigenous to Brazil and Peru. It is also met with as far south in Paraguay, La Plata, and Chile as the thirty-first degree of latitude. The tree is illustrated in the proceedings of the American Pharmaceutical Association for 1878. The natives of the extensive plateaus in the northern provinces of Brazil derive from this palm nearly all their means of subsistence and comfort. The wood, leaves, leaf fibres, leaf stalks, fruit, terminal leaf-buds, and the hollow stems are all of them used for numerous domestic purposes. The roasted fruit kernels furnish an agreeable beverage, known as café de carnauba. The most valuable product of all is the carnauba, or palm wax, which has become an important article of commerce. The root of this palm enjoys a high reputation in its habitat as an efficient alterative and diuretic. Possibly it may at

some time in the future become equally popular with sarsaparilla, stillingia, etc. Lescher's "Recent Materia Medica," 1888, mentions carnauba root as an alterative and diuretic, used as sarsaparilla in decoction of 1 part to 16, in doses of an ounce. (Parke, Davis & Co.'s Brochure No. 11.)

Oleo de Subati.—The fixed oil prepared from the pulp of the fruit of the *Raphia vinifera*, Beauv., var. *toedigera*, Mart., a magnificent palm flourishing in the moist lowlands of equatorial Brazil. Dr. Theodor Peckolt states that this oil has a reddish yellow color and a bitter taste. It is used internally as a tonic and externally as a lubricant for sprains, etc. (Pharm. Rundschau, June, 1888.)

BROMELIACEÆ.

Agave Americana.—The discovery of the juice of the "maguey" plant as an intoxicating beverage is dated as far back as 1045 to 1050, under the reign of the eighth king of the Toltec tribe. The diverse properties of the plant were certainly known many years before the discovery of Mexico by the Spaniards. The juice of the plant, or pulque, is consumed in enormous quantities, 50,000 bottles of it being annually introduced into the City of Mexico alone. It has been successfully used in the U. S. Army on the Mexican frontier for the prevention of scurvy. F. M. Murray claims that the plant which furnishes the pulque is distinct from the *Agave Americana*, and that it is properly named *Agave Mexicana*. The juice is said to have laxative, diuretic, and emmenagogue properties. (Am. Journ. Pharm., July, 1867.)

SCITAMINEÆ.

Banana root: *Musa sapientium*, Linn.; *Musa paradisiaca*, Linn. Indigenous to the tropics of both hemispheres. The root of the familiar banana is recommended by Dr. F. Frankenstein, of Hillsboro, Kans., as a remedy in bronchocele. (Parke, Davis & Co.'s Brochure, No. 6.)

CYPERACEÆ.

Espartillo: *Scirpus capillaris* is of frequent occurrence in the Argentine Republic, where it is employed in pulmonary affections.

EQUISETACEÆ.

Cola de Caballo.—A rare species of *Equisetum*, indigenous to the Argentine Republic. It has diuretic and astringent properties, and is used in its habitat in the treatment of gonorrhœa and diarrhœa. (Brit. and Colon., Drugg.)

DISCUSSION.

Dr. Rusby. Dr. Miller is deserving of the special gratitude of the section for taking up this important subject, even though the conditions of our present knowledge preclude even comparative completeness. The following points were noted in passing: Coto: It has been established that Dr. Schuchardt was in error in referring coto to a variety of *Drimys Winteri*. A number of barks of Bolivia are called by this name. I have recently myself received one new one, and four others are on their way. Boldo: I have evidence of the existence of a second variety of this drug, having seen a twig with leaves, evidently a species of *Peumus*, but not *P. Boldo*. *Violaceæ:* Only one medical plant was mentioned as belonging to this family, whereas it is very rich in them, ipecac-like properties being predominant. A drug which should not be passed by is the bark of several species of *Bocconia*, arborescent plants in the *Papaveraceæ*, yielding an abundant sanguinarine like

alkaloid. Jaborandi: Of the two varieties noted, the Rio is very inferior to the Pernambuco, but the latter is not yet in abundant or steady enough supply to specify it solely in the United States pharmacopœia. Rhatany: The drug now sold for *Savanilla Rhatany* is not genuine. It is a Rhatany, but not the old Savanilla. Baccharis: There is another species than the Mio-Mio, which yields an alkaloid, very bitter, and which acts as an anthelmintic.

THE PHARMACOPŒIA AND ITS STUDY.

By ROBERT W. GREENLEAF, A. M., M. D., of Boston, Mass.,

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Pharmacology, in common with other departments of medicine, is in a transitory stage. We must recognize that a new era is arising in the treatment of disease, coincident with the advance in knowledge, especially in the department of histology and pathology. Certain members of our profession, carried away by their studies in bacteriology, have been tempted to forget that drugs and their preparations still have a place in the armamentarium of the practicing physician. On the other hand, gentlemen trained in the encyclopedic methods of the past find it difficult to realize that many of their treasures from the animal, the vegetable, and the mineral kingdom are fit only for the departments of some museum devoted to the history of medicine. Between these extremes the pharmacology of to-day desires to take its stand. It desires to equip the physician, whose specialty it is to administer at the bedside of the sick, with a proper knowledge of the weapons he is to employ. With a consideration of the important classes of remedial agents other than drugs this section is not occupied. Suffice it to say that the therapeutic instruction of to-day is incomplete without full attention to such agents as electricity, water, food, etc. In regard to that special class of remedial agents which we designate as drugs while the number in use is much less numerous, yet the knowledge regarding them is on a far more advanced plane than hitherto. The time has come when a course of lectures on materia medica and another somewhat similar but less descriptive course on therapeutics will not suffice for the needs of the medical student. Our medical schools must provide instruction in the department of pharmacology corresponding in value to that in other scientific branches, or their duty is unfulfilled. Courses in pharmacology must be equipped with facilities for demonstrating practically the effect drugs are capable of producing in the animal economy, and for investigating the properties of new drugs as discovered. It is not enough to tell a student that digitalis is the leaf of such and such a plant, that it contains certain active principles capable of producing such and such effects on the circulatory system. The student must at some time in his course see for himself the sphygmograph inscribing its altered record. Would a college tolerate a professor in geology or botany who confined his instructions solely to the amenities of the lecture room, however eloquent or inspiring his words might be? Shall we, as physicians, tolerate or content ourselves with less from the teachers in our departments of science? Already our medical schools are facing this question. Already are our leading schools inaugurating successful courses in experimental pharmacology. It is not a part of this discussion to say what shall or shall not be taught in this department. Let us limit ourselves still further to the simple question, How shall the medical student become familiar with the pharmacopœia? Here again the progressive hand of science commands us to initiate the student into the mysteries of the drugs he is to use just as the chemist or the botanist does in his chosen fields, and here it is

that we find that our profession, in its specialization, has not fully adjusted itself. Let me briefly indicate the old way which appears to persist in many localities, and then outline what I conceive to be a wise method of treating this subject. We all know of instances where the young medical student, too often ignorant of biological methods and knowledge, moreover, ignorant as yet of the pathology of disease, is introduced to a jargon of technicalities; in the early part of his course is informed that the pharmacopœia is the official organ of a learned committee representing the various medical and pharmaceutical societies and that it is revised to date every ten years; is treated to a learned course of descriptive lectures; is shown from the lecture table a host of bottles or a meaningless array of lantern slides or gaily colored plates. The wild Indian thought of killing a photographer because he found himself represented as a half man, he being unable to appreciate the effects of light and shade. It is hard to realize that the young student of science is no better off and must first be taught to read. His early steps in science are as those of the crawling infant. Is it to be wondered at that at the close of such a course, however eloquent the teacher, the average student votes materia medica a bore, throws away his pharmacopœia, if he ever had one, and, except for the purposes of an examination, knows absolutely nothing of that remarkable, erudite, and most useful work, the pharmacopœia, save in relation to a dozen or so drugs, which even then he is able to administer only in the crude, often offensive, ways of his hospital or dispensary experience? Is it any wonder that in his innate sense of the fitness of things, when he finds his private patients demanding agreeable-tasting and sightly preparations, he falls an easy prey to the first manufacturer who floods his office with attractive and plausible circulars, samples, and other baits of enterprising business greed? It is extraordinary that this matter has received so little attention at the hands of the profession. And it is a striking commentary on our carelessness, I may even say on our credulity, when our medical societies, even our great medical congresses, will content themselves with an exhibition of so-called pharmacy represented solely by the pretty preparations of a few manufacturing concerns, with here and there a patent food or water thrown in to vary the scene. The bait of a neat $12 case with dainty tablets of all the drugs he remembers having heard his professor laud so highly is too much for him, and in his ignorance the medical tyro begins his career regardless of the fact that medicines change their properties with age, that pills will not always dissolve when wanted, that some may even pass the exit gate without effect, that the pretty tablets may irritate where soothing was indicated. He is fortunate if in giving two different kinds he does not some day blow up his patient by some unforeseen explosion; or if the unwitting patient, having been told to dissolve the compounds, has not saved most of the drug for a last, perhaps a fatal, dose.

There is no reason, gentlemen, why this subject should not be made as attractive and as valuable in a medical school as it is in the colleges of pharmacy. In them a new era has begun. We cannot all teach as Agassiz taught. Such a genius is one of a century, but any true teacher can make his student enjoy his study and come to it and take from it with the zeal and profit of the naturalist. This is done in our colleges of pharmacy, and can be done in our medical schools as well. The steps are the same in kind, the only difference being that the pharmacist in his line of specialization must travel further. Now, let us consider what these steps are. The young student of pharmacy is required to know enough of elementary botany and chemistry to understand the main anatomical and chemical features of the drugs studied. Should the physician be less well prepared? He is then given actual specimens, not merely lecture-table specimens, but actual hand specimens for his personal study—to taste, smell of, and look at, inside and out, to examine microscopically as well—then to keep for his private ownership, review,

and comparison with later specimens, to his heart's content. Having made his own observations, sometimes, to be sure, under the guidance of his teacher, he is then required to compare his data with the descriptions of an authoritative treatise. Such is our pharmacopœia. If he chooses to improve his phraseology by adopting that of those of greater experience than his own, he may do so, but that is of secondary importance. The fact is what is wanted, and the fact studied in such a way is the student's own. Instead of passing in one ear and out the other, it has come to stay, and has come in wisdom's way, which is a way of pleasantness. Our pharmacopœia describes all drugs now regarded as of value in language descriptive of results derived from study of such a character. Each student of pharmacy must practically make his own pharmacopœia in precisely the same way. Each medical student should make his own pharmacopœia, which of necessity must be still smaller, according to his special needs, in practically the same way also. Not having time enough for all he must learn types—for example, as digitalis leaves—then, though it would be well, he need not carry out every step in the study of other leaves as belladonna and stramonium. It is not his function to purchase fine specimens for the preparation of their active principles, nor to detect adulterants, etc., but before understanding the use of tinctures, fluid extracts, pills, etc., he must know something of the crude drugs from whence they came.

Next as to how he shall master what he should know regarding those preparations; and it is just at this point that our medical schools are most liable to fail, excepting a few who demonstrated, perhaps, a single percolate from their lecture tables. The older teachers contented themselves for the most part with stating that the pharmacopœia contained specific directions as to how these classes of preparations should be made. So it does, and soon the student of pharmacy learns to admire the care and painstaking with which the best methods for making the many preparations of the pharmacopœia are presented. It is important for the pharmacist to be familiar with all. It is not so for the medical student. Nevertheless, he must know the types, or he will soon be making the needless errors which make him present so pitiacle a spectacle of ignorance to the pharmacist, and become so dangerous or obnoxious to his patients. The neglect of instruction in such matters in our medical schools is a discredit to our profession. If it is worth while using tinctures, etc., in our practice, it is worth while knowing something about them; and, as with every other objective study, there is no better way of learning about a thing than to see it and study it objectively. I would have every medical student understand the classes of preparatives of our pharmacopœia. I would have him make in the laboratory at least one illustration of each. I would have him blend them in various ways just as he is to order them blended in his later practice. Thus he would soon learn the beautiful and nice proportional relations presented in our pharmacopœia as existing in the strength of these various preparations. He would soon learn to avoid incompatible and unsightly mixtures. He would soon know what he wants to use and how to direct its preparation. Fancy a captain ignorant of the manual of arms. That is about the position of many a student of the old régime regarding the mixing and prescribing of drugs. But a new era is at hand, and it is noteworthy that those colleges which equip their students in such a practical, scientific way furnish our profession with men who find their studies full of interest and have become the foremost physicians and therapeutists of the country.

DISCUSSION.

Dr. H. H. Rusby. The idea has been advanced that the possession of this knowledge of pharmacy would tend to induce the physician to dispense his own medicine. My own idea has always been that, on the contrary, it would give him an adequate idea of the importance of the subject, so that they would not "rush in

where angels fear to tread." I always tell my students and inquiring friends that the University of Pennsylvania has the best medical course in the country. The institution which has the wisdom to introduce this study has good wisdom for use in other directions.

Dr. A. W. MILLER. The paper to which we have just listened reminds me very forcibly of the remarks which I am in the habit of annually making to the students of the University of Pennsylvania. As near as I can recall, I have there for years advocated the same reforms which he has recommended. It is a part of the educational plan of the medical department of the University of Pennsylvania to make the study of pharmacy obligatory on all of its students, excepting those who are either graduates of pharmacy or have had several years' practical training in drug stores. During the first course of medical instruction the student is compelled to devote one whole evening, that is, from 7:30 to about 10 o'clock in each week, to practical work in the pharmaceutical laboratory, including practice in the writing of Latin prescriptions. I have again and again been assured by many of our graduates that they have found the practical instruction in the pharmaceutical laboratory to be of greater benefit to them than that of many other laboratories.

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ADDRESS OF THE PRESIDENT OF THE SECTION, HON. ALONZO GARCELON, M. D., LEWISTON, ME.

Although four centuries have elapsed since the discovery of this continent and its occupancy by the civilized nationalities of the world, now for the first time since that important event the medical profession of the various governments into which it is subdivided have, by their delegates duly appointed, assembled this the 5th day of September, 1893, for the purpose of conferring together and discussing subjects of especial importance not only to themselves but to the communities they represent. With the end in view that the best results attainable may be

secured, the committee on organization have arranged for the meeting of sections for a discussion of special subjects, among which is that of medical jurisprudence, a section of great importance but seemingly a sort of *bête noire* to both the profession of law and medicine. The literature of the subject is meager, and buried for the most part in the intricate labyrinth of medical and law reports, jury trials, and legal decisions. Our institutions for instruction pay but little attention to the subject and make but little or no provision for giving their students even a hint of its importance and bearing upon the happenings and well-being of society. If, as our most distinguished lexicographer asserts, jurisprudence is the knowledge of the law, customs, and rights of man in a state or community necessary for the due administration of justice, and that its study next to that of theology is the most important and useful to mankind, what are we to say of those schools, whether of law or medicine, claiming to stand in the front rank of all important teaching in whose curriculum such a term as medical jurisprudence has no place and whose graduates go forth with as little knowledge of the importance of the subject or of their daily liability to be engaged in cases where the property, the freedom, the reputation, or the life even of some one or more persons is involved as the newborn babe has of the alphabet. In the broad catalogue of murders from whatever cause, there is scarcely a case in a thousand brought into the courts but demands the testimony or opinion of a medical witness. A brief allusion to some of the occurrences which every member of the medical profession in his daily walk through life is liable to meet with should convince him of the importance of the subject and impress upon him the necessity for appropriate preparation. Insanity, that mysterious, manifold, and ever to be dreaded disease, is ever present with us. Its form is protean, and in numerous cases it is difficult to determine its existence. Horrible crimes are committed under its influence, but others of equal atrocity are actuated by malignity, revenge, avarice, or some other cause, and the plea of insanity in some of its protean forms is alleged as justification or excuse. We have not only monomania, dypsomania, kleptomania, moral mania, but emotional mania and a host of other manias so numerous and varied that it seems possible to classify the whole human race under some form of mania, or in other words to declare that we are all maniacs. In these days, when the invention of new terms seems to be regarded as a recommendation of merit and every author upon almost every topic seeks a new classification, the medical man who is called upon to testify oftentimes finds himself in a most embarrassing position if he is not well posted upon the subject at issue in all its ramifications. Writers upon insanity form no exception. The classification of Esqurol, who is recognized as standard authority, is modified by Ray and rendered more complex. Flemming is still more so. His first divisions are two: Imbecility and mental confusion. Imbecility he subdivided into origin and extent; mental confusion into disorders of temperament, disorders of the understanding, and general depravity, and his subdivisions are run out into extremely fine points. Wharton and Stille adopt this classification, saying "it is very valuable both for the delicate precision of its analyses and for the important aid it affords to the nomenclature of forensic psychology." In looking over these classifications by such authorities and such divisions and subdivisions we find such terms as "anosia," "oikeiomania," "pyromania," "oideiomania," "pseudomania," "fanaticomania," and hosts of others. The ordinary practitioner might think that the writers had themselves run mad. It must be remembered, however, that as these divisions and subdivisions are found in all the books on insanity the attorney has a right to demand, when a medical witness is placed upon the stand, if he has given the subject especial attention, that he will be able to assign to each case its proper class; and if he fails to do so, as he very likely will if in the hands of a sharp examiner, he is regarded as an ignoramus or pretender, and leaves the

witness stand mortified and ashamed and a laughing stock to the gaping crowd in attendance. The attorney is disgusted, the judge astonished, and the jury in greater doubt than at the beginning of the investigation. It is therefore of the greatest importance that every man who enters the field of practical medicine should be a man of thorough education in all departments or forms of mental alienation. It is not to insanity alone, however, that the attention of the physician is most frequently directed or his opinion demanded in cases involving medico-legal investigation. Death under suspicious circumstances is of lamentably frequent occurrence. Was it the result of accident, suicide, or crime? Did the sandbag, the stiletto, strangulation, or the bullet do the deed? Was anæsthesia or poison the cause; and if so, which and what? Was there latent disease of the heart or other organ to account for death? To the medical examiner a wide field for investigation is opened. Science has done wonders in aiding the detection of crime, but at the same time it may be by no means certain that it has not done much more in aid of its commission. Hence the importance of thorough work. The negative as well as the positive must be proved. If such as are more frequently employed are not found, others must be sought for, and the search continued, having in view the purpose to let no guilty party escape.

Apart from the liability to be connected with medico-legal examinations previously alluded to, and to which every physician is subject, there are others of great importance demanding a thorough education of the practical practitioner. In cases of divorce, protracted gestation, premature labor, and impotency important interests are often at stake and the knowledge of the medical witness put to a severe test. The very earliest work found in looking over the bibliography of medical jurisprudence is one published in 1612 by Tagereaux, entitled, "Discours sur l'Impuissance de l'Homme et de Femme."

In 1714 an important case was tried in Paris involving the question of impotence which gave rise to the publication of two volumes entitled "Impotentia; the Case of Impotence Debated in the Late Trial at Paris." Closely allied to this question are those of protracted births, *naissances prétendues tardives*. About 1765 a contested case for divorce or inheritance gave rise to several treatises by such authors as Bouvart, Barbeaux, Bas, Bertin, and a year or two later a work in two volumes by A. Petit. I doubt if any better résumé upon the subject can be secured in works of more recent date if such are in existence. In a community when great wealth and loose morals are frequently allied, when criminal abortions are numerous, and injudicious marriages frequent, divorces easily obtained, maternity revolting, and attention to the care of a family incompatible with social life, the dance hall, the theater, the card table, and other amusements, it would not be surprising if medical men were more frequently summoned to give evidence in medico-legal trials involving some one of the various crimes to which allusion has been made.

Enough, however, has been said upon this branch of the subject to give a hint at least of its importance, and we will pass to the consideration of cases of a different type, but of vast importance to municipalities, corporations, and individuals, which very frequently require the testimony of medical men to secure settlement. I allude to those arising from defects in the public highways, railroad accidents, explosions, want of proper supports or defective hoisting apparatus in mines or manufactories. In cases of injuries of this nature, whenever the municipal officers, railroad officials, or agents of corporations refuse to settle upon terms which the injured party believes to be just, and where there was an absolute defect or gross carelessness on the part of the corporation, he appeals to the courts, and a medico-legal investigation becomes a matter of necessity to determine the extent and nature of the injury. In many instances medical experts, in addition to the injured party's attending physician, are called upon to give testimony in the case.

It is now a common practice with our railroad corporations to enter into a contract with one or more surgeons to attend upon cases of injury occurring on their respective lines, and such is human nature that almost constantly the weight of their testimony is found to favor the interests of their employers and minimize the degree of the injury sustained by the sufferer. On the other hand, the injured party is quite as apt to magnify his suffering, and with the hope of obtaining excessive damages sometimes claims to suffer from causes not apparent and which are without foundation. Particularly has this tendency been observed among those who have brought actions against municipalities. Municipal officers, like railroad surgeons, have an interest at stake, and oftentimes very unwisely refuse to do that, as expectants for future election, which they would do as disinterested parties. They refuse to make a reasonable compensation, if any. The injured party is determined to have a pecuniary remuneration not only for injury, but for suffering endured, lapse of time, and for anticipated infirmity. The attorney is consulted, perhaps a shyster ever seeking to encourage suits, who advises that no settlement should be made, but that action be brought at once. This done, the plaintiff's difficulties make no improvement. Indeed, they seem to increase. He can not step with the same firmness. His spine is now painful. His lower extremities have lost their feeling, and he feels he is permanently injured and a confirmed cripple for life. The case comes to trial. Experts are consulted. Every physician who has had aught to do with or examined it is summoned. He goes upon the witness stand, and with lugubrious countenance details his condition and sufferings. The jury is touched by his narration. The weight of evidence favors his plea, and a handsome verdict is the result. He leaves the court room with the sympathy, it may be, of the mass of spectators. In a few weeks a remarkable change has taken place. His general appearance has improved. He moves with greater certainty. His cane, or crutches, as the case may be, is laid aside. Some good lady has recommended a favorable panacea, it may be goose oil, or stork's oil, or some wonderful plaster, from which he has received great benefit. It is truly surprising what an effect it has upon him, and he now has great hopes of a permanent cure. This is no burlesque description of actions of this type, and I doubt not its parallel has fallen under the observation of every man who has been an observer of cases of the kind described. Quite a number have occurred under my own observation during a half century's practice. I trust you will pardon me if I give a single instance, one of actual occurrence, in all its details and from which a deduction valuable to every medical witness may be drawn:

A minister of the gospel in regular standing in the society to which he belonged was thrown from his carriage while crossing a railroad track and received an injury of the spine, as he alleged, which confined him to his bed and house for quite a number of months. It was in dead winter and a deep snow lay upon the ground. The snowplow had thrown quite a ridge of snow upon the side of the track, and as the roads crossed each other at quite an oblique angle sleighs were quite easily overturned. There was no question as to the defect in the highway, but a dispute between the town and railroad as to the liability. Both declined to settle the damages claimed. After a delay of a year, more or less, a suit was brought against the town. In the meantime the injury did not improve, but grew apparently worse. Numerous physicians were consulted, but the trouble did not abate. His crutches were his constant companions, and all medicines failed to relieve his suffering or restore the action of his limbs. He was sure he was a cripple for life. He spent much time in hunting up evidence and creating sympathy for his misfortune. At length the case came to trial. When he entered the court room he could walk only by aid of his crutches, and when upon the stand the story of pains by day and torment by night was painted in the glowing colors of an eloquent divine. A minister of the gospel could of course tell nothing but the truth, and as pain and suffering can be felt only by the sufferer, and the extent of the injury of the spinal column not always possible to demonstrate, and the prognosis not by any means certain, an award was rendered the plaintiff in this case of nearly $3,000. The award was made at the April term of court and the

plaintiff hobbled from the court room with apparent difficulty. Not more than three to four months afterwards I was aboard a railroad train on my way to a neighboring city, and as the train stopped at a way station for the reception of passengers a gentleman entered the car which I occupied who strongly resembled the plaintiff I had last seen in court. But as he walked without crutch or cane, I at first thought he must simply be "a double," to use a favorite phrase of the late Prof. Dixy Crosby. Closer scrutiny convinced me that I was mistaken, and that he really was the man in question. Of course my curiosity was aroused to learn by what means so great a transformation had been so suddenly and so effectually secured. I seized an opportunity to speak with him. In answer to my inquiry he replied: "Thank the Lord, it is the result of prayer. I retired at night after having prayed long and fervently that I might be restored to health, and when I awoke a feeling came over me that I should recover, and when I got out of bed I found that I could stand without the aid of a staff. I then made the attempt to take a step, which I did. I then tried another and another, until I had walked to the bureau across the room; and since that time, praise be to the Lord, my health and strength have wonderfully improved." I am sorry to add that there are many familiar with the case who are so very wicked that they put but very little confidence in the cause of the cure.

In the course of a professional experience of more than half a century I have had the opportunity of observing the history of nearly a score of medico-legal trials of this character, and, while no others have attributed their recovery to the efficacy of prayer, the larger proportion have recovered very rapidly after an award of damages in their favor. My advice to professional men who are summoned to give testimony in a medico-legal case where a question of damages is involved is not to be too positive as to their prognosis.

In the early years of my practice I had a patient who received a severe injury of the spine in consequence of an obstruction of the highway. She was a severe sufferer for many weeks, and damages were claimed. I advised both parties that a mutual agreement would be the best for all concerned, especially as there was no question of the unlawful nature of the obstruction or want of care on the part of the plaintiff. At the request of my patient I named a sum which I thought to be small enough in all reason. The municipal authorities were unyielding, thinking that my judgment was biased in the lady's favor, and chose to test the case in the courts. There was living at that time in a distant city a distinguished gentleman and surgeon of eminence who was frequently called as an expert and whose opinion with judge and juries was equivalent to law. His grand personal physique and dogmatic method of expression gave him a commanding influence. He was called by the authorities to give his opinion in the case. He visited the patient, learned the history and progress, and when he was asked by the town's attorney as to the prognosis or probability of recovery he very positively declared it to be unfavorable, with no hope of improvement. He had been familiar with injuries of like nature and he would not admit of a reasonable hope. Such was the effect of his testimony that the jury awarded damages about four times what the plaintiff would have obtained by my advice. The result was that within six months she was able to go about her house, and in less than a year and a half after that was able to attend to the ordinary domestic duties of her family, and for many years has enjoyed excellent health. The "*vis medicatrix naturæ*" oftentimes produces unexpected results, and it is not wise to ignore its possibilities or honest to attribute to inert prescriptions and panaceas her potent influence.

Let us now pass to the consideration of another class of cases, by far the most frequent which occupy the courts and most especially affect the reputation and pockets of the practitioner. There is not a member of the profession who is not liable, justly or unjustly, from malice or jealousy, for the purposes of blackmail, or for some cause beyond his control, to be summoned into court to answer to a charge of malpractice The frequency of suits for damages, as well as for criminal practices, are alarming both to the profession and to the public. As to the latter, I am quite sure, frequent as they are, not a tithe are ever exposed to public gaze and the culprits brought to the bar of justice. There are without question many men in the ranks of the profession bearing diplomas which qualify or rather entitle them to rank as members in regular standing, who do not hesitate for filthy lucre to run the risk of exposure and disgrace, and subject them-

selves to the penalty attached to their crimes, hoping, as all criminals do, to escape conviction. As to civil actions, they will necessarily occur so long as ignorance and incapability are prevalent in our ranks. But neither ignorance nor incapacity are the sole grounds of actions of this nature. Men of ability, experience, and education are sometimes brought into court and subjected to heavy expenses without fault on their part, owing to the prevalence of the opinion that certain results are the proof of want of skill. These actions arise mainly as the result of amputations, dislocations, and fractures, but sometimes of incised wounds and operations upon the eyes and other organs. So frequent have been these actions that some practitioners absolutely refuse to attend upon surgical cases at all. It is but a few years since the committee upon the subject reported to the Ohio State Medical Society "that in their opinion the subject of malpractice was of more importance to the profession than any other connected with surgery." They say, "There is a standing and accumulative evil—an evil bearing with the weight of an incubus upon the profession." The cases reported, with several not included in the report, were forced upon the attention of a single member in the past year. During one week, in as many different counties, four cases were tried.

These statements are all illustrated by several cases, in each of which the alternative was presented to the surgeons, all of whom were regarded as well educated men, either of compromising not only their own reputations but the honor of the profession by paying damages, or a trial in court, when a verdict in their favor would be attended by loss of business and heavy expense in carrying on the trial. It is unquestionable that many cases of this kind occur, but how many will never be known, as there is no possibility of obtaining a record. But, on the other hand, there are numerous instances, judging from my own observation, where it would be simple justice that the incapacity and ignorance of the pretended surgeon should be exposed by a public trial. Judging from my own observation and the deformities so frequently noticed, after making all due allowance for unreasonable prosecution, I am convinced that there is a vast amount of ignorance and incapacity in the treatment of wounds and injuries of the human system, and I feel equally certain that the average acquirements and natural ability of the great majority of professional men in the region of my observation will compare favorably with an equal number in any section of the country. The truth is the medical profession, like that of law and theology, embraces quite too large a proportion of imbeciles who are unfitted both by nature and education for the practice of any profession. A few cases in illustration will need no apology:

A little girl of 5 summers received a fracture of the right femur at or a little above the junction of the middle with the upper third. An uncle of the child was the physician of the locality, and took charge of the case. After a period of ten days, the sufferings of the child had so worked upon the feelings of her parents and grandparents that the latter insisted that counsel should be called, to which the doctor was decidedly opposed. He was overruled, and my services were decided upon. The doctor himself came for me, saying that nothing was to be done at this stage of the case, and that ossification had probably taken place. Upon this representation I declined to go with him, but yielded to his solicitations and to the assurances that whatever was necessary might be done. It was midsummer. The best feather bed in the house had been appropriated for the comfort of the little sufferer, and it lay ensconsed in its folds. The sheet being removed I noticed, even before the dressings were removed, that the upper and lower portions, of the shaft of the femur formed an angle of not less than 45 degrees. In reaching down to examine a little more critically the kind-hearted, anxious mother, seizing my arm, exclaimed, "Surely, doctor, you will not do anything to the limb! The doctor says she will die if it is disturbed." An examination disclosed the fact that the only support or dressing applied to the limb consisted of four little splints, 1 inch in width and less than 4 inches in length, applied to the limb with a roller bandage, and as the fracture was considerably above the middle of the shaft there was absolutely nothing to prevent the free movement of

the broken shaft whenever there was a movement of the body. The upper extremity of the shaft was drawn forward and the limb shortened nearly or quite 2 inches.

A gentleman from a distant State, on a business tour, was thrown from his carriage, receiving a compound comminuted fracture of one of his legs near the middle, while passing through a neighboring village, some 20 miles distant from my residence. The accident occurred directly against the residence of the village physician, who kindly proffered the use of his house and his attentions in the treatment of his case. Two weeks later I was called for consultation. The surroundings were comfortable; the bed a mattress on which was a bed of feathers, and across this a folded comforter, so called in New England, the lower folded edge of which was so placed as to come about on a line with the fracture of the limb, permitting the heel and lower extremity of the fractured limb to drop several degrees and causing quite an angle at point of fracture. Two strips of board were used, 2½ inches in width and long enough to extend from upper extremity of the tibia to the bottom of the foot. Short pieces of red tape were attached to the top edge of these strips and the apparatus was placed by the side of the limb and not confined to it in any manner save by tying the strings of tape together over the top of the leg. A long piece of similar tape was tied in the middle around the great toe of the fractured limb and the end of the strings were attached to opposite footposts of the bedstead. A poultice was applied over the wound, which being removed, a denuded portion of the upper extremity was brought to view, and beneath, a large collection of pus. Two attendants were present, who stated that they had been in constant attendance from the first hour of the injury, either one or the other constantly holding the limb to control its spasmodic action, which was extremely frequent and intensely painful. The suffering of that fortnight can be imagined quite as well as described.

A lad of 12 or 13 years of age playing with other boys fell from a sidewalk to the street and both bones of one arm were broken. The doctor of the village, with some claims as a surgeon, was called to attend the case. He claimed to have reduced the fracture, but as there was a tendency to a little more bulging or prominence over the region of fracture, he thought to remedy the defect by tightly applying the bandages over the splints. Notwithstanding the young patient suffered extreme pain, he declined to make any examination or remove the dressing before the eighth day, when to his astonishment the entire hand and arm was in a state of gangrene as high up as the fracture, except a little strip along the under edge of the ulner to the wrist joint, three-fourths of an inch in width. The result was an amputated arm. The bones were found overlapping each other, and without question reduction had never been made. It would seem that nothing short of ignorance could be pleaded as an excuse for such a mistake and a want of that faculty commonly called "common sense."

I have not cited these as unique or without a parallel, but on the contrary their type is found in every community, and I have the impression that there are but very few professional men of long experience who have not met their counterpart in one form or another. And let it not be said that these men were "wicked beyond all who dwell in Capernaum," for they were all graduates of some reputable medical college and stood on a par with a large majority of those who annually go out upon the community with diplomas in their pockets. Nor let it be suggested that they were graduates of a bygone generation who had not the facilities of a medical education in a reputable college. If the report of the qualification of a graduate given in the Journal of the American Medical Association be true, as it unquestionably is, no limit can be given to the stolidity that may be rewarded with the prize of a diploma, even at the present day. The truth is these men, like thousands of others, had mistaken their calling. They had no mechanical ingenuity, and you might as well attempt to make a musician out of a child with a cleft palate as a surgeon out of a man deficient of mechanical ingenuity. Natural abilities, supplemented by the best education with assiduous application and perseverance through a long course of study secure, are absolutely essential to qualify any young man for the duties and the responsibilities of the practice of medicine, and with all these can give him he will soon find that he has but just entered upon the threshold of the temple of knowledge, and when he enters upon the domain of surgery he will find that something more is wanting than a knowledge gathered from books.

In the remarks I have thus far made I have endeavored to illustrate the importance of the subject of medical jurisprudence and its demands upon the members of the medical profession, their responsibilities and liabilities, both as witnesses and defendants. It is true that as defendants it is almost always in the capacity of a surgeon that the medical man is called to account, but it is not less true that there is quite as much more ignorance and malpractice in the treatment of ordinary diseases as in the management of surgical cases. But dead men tell no tales, and as a general rule the effects of the incompetency are out of sight and accounted for on other grounds. It is not to be expected that incompetency and ignorance will be weeded out of the ranks of the profession, but by united effort a great advance can be made and the evil reduced to a minimum. To accomplish this result the work must begin at the foundation. The body politic must be educated to a just appreciation of the importance of furnishing proper means and opportunities for acquiring a thorough training, throwing such restrictions around the facilities as will keep at bay all dotards and incompetents. Take away the right of practicing medicine by virtue of a diploma from medical schools without an examination by a competent board of medical examiners. To this end the physicians must coöperate. In fact the work must be done mainly by themselves. There is already in the field an army of faithful workers. The American Medical Association was started fifty years ago for this very purpose. It has done much, and yet how little. There are mountains of prejudice to be undermined. The great body of the profession is lukewarm toward improvement, and refuses to coöperate with those who are laboring for the best interests and glory of the world and the well-being and happiness of the people. Of the 100,000, more or less, practitioners of medicine in this country, less than 5,000 are enrolled as members of the association. There ought to be at least 80,000, marching in solid column to the halls of Congress, demanding the establishment of a national university such as the world elsewhere does not furnish the equal, opening its doors freely to all who could pass the ordeal at the gates of its portals and remaining only so long as an annual examination certifies to their ability and efficiency. Our State organizations and local societies must press on the work and demand of our State governments to require proper qualifications for admission to the ranks of the practitioners of the healing art. Medical colleges organized by State authority should require a certificate of qualification by the State board of medical examiners before admission to their halls. The standard of qualification should be fixed by a national board. Local schools of instruction and individual practitioners in State and county should require a certificate of qualification of literary or scientific attainments according to a standard adopted by their respective State societies. The adoption of such a system would in a few years fill the ranks of the profession with capable and efficient recruits and relieve it of the incubus under which it rests. And I am very sure in a comparatively short time questions of medical jurisprudence growing out of malpractice would be relegated to past ages, and ignorance and stupidity find no standing place in the ranks of a profession that has no equal in its importance and utility to the suffering of the human race. Of the status of the subject in our sister Republics I have no knowledge, but trust our confrères will enlighten us, and trust that the discussion that follows will prove of mutual benefit and give us all a higher appreciation of the importance and responsibilities of the subject of medical jurisprudence.

PAPERS READ BEFORE THE SECTION.

CHANGES IN THE MANNER OF CONDUCTING CASES OF CRIMINAL POISONING.

By R. OGDEN DOREMUS, A. M., M. D., LL. D.,

Professor of Chemistry, Toxicology, and Medical Jurisprudence in the Bellevue Hospital Medical College, of New York.

Having been engaged in studying, teaching, and practicing the subject of toxi cology for over forty years, I may be pardoned if I venture to suggest to you honorable body certain important changes in the manner of conducting cases o criminal poisoning. Great discredit to science has resulted from the discrepan testimony in courts of justice between experts in pathology and in toxicology Both judge and jurors are bewildered. To decide between the learned contestant is difficult. All who have attended criminal trials involving such scientific test mony, either as witnesses for the prosecution or for the defense or as intereste auditors, are familiar with the efforts often made to impugn the experts. Que tions are asked derogatory and detractive, sometimes almost insulting in thei character, intended to disconcert and annoy the witness. Instead of the caln ness and self-possession which should be the privilege of the expert, he is not onl irritated and annoyed, but must exercise his wits in attempting to meet th attacks of members of the bar, who from constant practice in courts acquire skill he rarely possesses. There are most competent and superior pathologists an chemists who are debarred from participating in these cases, and the cou deprived of their valuable knowledge and experience, from a dread of bein exposed to ridicule and contempt by pettifogging lawyers. I respectfully propos that in a case of suspected poisoning the coroner, the district attorney, or th court allow the arrested party to have his or her representative pathologis present at the autopsy with the pathologist selected by the prosecution. Also toxicologist, who, with the chemical representative of the State, shall decide o the parts of the body to be removed for analysis, and that the two experts sha conduct the research together. If the prisoner is unable to bear the expens necessarily involved, I would insist that the court should provide for the same, a has long been the custom in appointing legal aid for those whose means dete them from engaging counsel. Of course the investigations should be conducte in pathological and in chemical laboratories, to which no one should have acces excepting the experts. Such laboratories should be locked and sealed by eac investigator when leaving, and one should not reënter the laboratories unles the associate is present, each breaking his own seal. As mere traces of poiso can be detected, it is essential that the chemical laboratory should be provide with new glass and porcelain vessels and as pure chemicals as can be procured In most cases the first duty devolving on the experts would be to purify sai chemicals. After consultation the chemists would agree on certain methods o procedure known to them and which appear in detail in works on toxicology They would keep separate records of each step taken in the research. They woul simultaneously witness the changing or evanescent color reactions, as in alkaloid poisons, and where doubtful repeat them until their conclusions agree. Whe possible, they should reserve as exhibits in court at least portions of the poison o poisons discovered in the various organs of the body or from the contents o certain of them. Neither time nor care should be spared in making the researche complete and harmonizing in their deductions. The advantages accruing fro

is mode of procedure would be the avoidance of discrepant testimony; more-
er, the findings of the pathological and chemical experts would be accepted as
ets. This would not only prevent opprobrium being cast on scientific researches
d restore them to their eminent position with the community; but as the pro-
nged and tedious wrangling of the opposing litigants in regard to expert testi-
ony would be avoided, it would diminish the labors of the court, the counsellors,
d the jury, thus facilitating a just decision.

It is painful to consider the manifold duties of the jurors. Taken from their
cupations and from their homes, confined many hours each day in the vitiated
mosphere of a crowded court room, they must attentively listen to the details of
e circumstantial evidence, to the testimony of various and varying experts in
edical practice, pathology, and chemistry; hear the discussion of scientific mat-
rs, in terms unfamiliar to their ears, by the prosecuting attorney and the legal
fender of the accused, and after instructions from the judge on legal points
empt intellectual digestion of the incongruous mass and harmoniously unite
a verdict. What wonder if one or more of them should succumb under this
mbination of conflicting considerations. More effectively to impress this sub-
ct, let each one who has patiently followed these considerations suppose that he
as under suspicion or arrest for the cowardly crime of poisoning. No matter
ow distinguished the pathologists and the chemists appointed by the court or by
e prosecuting official, would he not earnestly desire that his own representatives
ould be present during the investigations involving his reputation and possibly
s life? I, for one, most certainly would. I have zealously taught this doctrine
my lectures on medical jurisprudence to the students in Bellevue Hospital Med-
al College.

I would respectfully commend another theme for the consideration of your hon-
able body. I have keenly felt great antipathy in being obliged to testify in a
urt room open to the public, and always partly filled with those of the gentler
x, to extraordinary methods of poisoning, even through the genital organs, and
other matters unfit for ears polite, yet essential in the trial. Testimony has
equently to be given and discussed of immoral practices of the accused which
ford instruction in evil ways it were better should not be presented to the com-
unity. St. Paul wrote to the Corinthians, "Evil communications corrupt good
anners." Though nineteen centuries have elapsed since this wise record was
ade, human nature has not risen above its applicability. Hence, I would strenu-
usly urge that when such testimony as referred to has to be offered that the
esiding judge should allow only the necessary officials and the jury to be present.
urthermore, that the representatives of the press be excluded at the same time.
here are some journals of extended circulation that boast of publishing accurate
tails of every *cause célèbre*.

While the judicial halls can contain but a few hundred persons, who may listen
disgusting and demoralizing narrations, the newspapers distribute the same to
illions of readers on the American and European continents; in fact, around the
orld! The strictest scrutiny is conducted forbidding the sale of immoral photo-
aphs; yet pen pictures of a most indelicate and heinous character are purchas-
le for a trivial sum of money, and read, not only by adults of both sexes, but by
ys and girls, and discussed in the streets, in public vehicles, and even in the
cred precincts of home, where purity of thought should never be tarnished.
is proposition may be considered Utopian, and contrary to the principles of
epublican and free government; yet thirty years ago, when imperial rule
sted in France, this method prevailed of excluding the public and the press, at
rtain portions of the trial, when testimony of the character described was to be
ven. During the years 1862 and 1863, while residing in Paris, I was invited by
embers of the French bar to attend certain important criminal trials, and can

bear personal testimony to witnessing the clearing of the court room of its auditors and of reporters, the legal representatives alone being allowed to remain when themes of an immoral nature, yet essential for the administration of justice, were to be presented.

A third important element in the proper performance of a toxicological research is a fitting remuneration to the expert for his elaborate work, which may involve weeks or months of his skill. He must also have frequent consultations with the coroner and the district attorney. The latter officer he must instruct in the details of the chemical analysis, to arm and equip him for attacks from the defense and to protect his own witness. I am proud to say that many eminent members of the bar, renowned in criminal trials, have honored me by working faithfully in my laboratory to familiarize themselves with the chemical reactions. The expert for the State must not only prepare his exhibits for the court, deliver his testimony, and submit to rigorous and sometimes to insulting cross-examination, but he must also be present to hear and suggest criticisms of the experts for the accused, involving additional time. The presiding judge and the prosecuting attorneys, as well as the coroners, are salaried officers. Distinguished counselors for the defense receive generous fees. Up to the year 1858 the well-known toxicologist in New York City, Dr. James R. Chilton, informed me that he received, two or three years subsequent to his analytical labors in a poison case, the sum of $25. The same custom prevailed in Boston even many years after the period mentioned, as told me by the eminent chemists, Dr. Charles T. Jackson and Dr. Augustus A. Hayes, of that city. This small fee did not warrant the expense of special laboratories and new vessels. The analyses were conducted in their ordinary laboratories, where visitors were daily received. This was manifestly unjust to the accused. A large majority of the better instructed citizens of the United States are ashamed of the inadequate compensation given to our public officers. It applies to the President, to the members of his Cabinet, to officers in our Army and in our Navy, to our foreign representatives, and to the judges of the Supreme Court of our country. It also appears in our institutions of learning. Prof. E. N. Horsford, when occupying the Rumford professorship in Harvard University, told me that young men of superior intellectual gifts and graduates of that college had to differentiate between a business career with marriage, and a possible professorship with celibacy. In the summer of 1885 the distinguished chemist, and one of the authors of the valuable work entitled Forensic Medicine, Prof. C. Weymott Tidy, while we were discussing the subject of medical jurisprudence at his residence in London, stated to me that he had abandoned making toxicological analyses for the Government. I replied "I think I know the reason for this decision, so unfortunate for science. To use an American phrase, 'It don't pay.'" He honestly acknowledged that I was correct. I told him I was proud of having broken an equally unjust custom in New York. That in 1858 (now thirty-five years ago) I declined to undertake an important poison case unless promised proper remuneration. I explained to the authorities that I should require an especial laboratory and a dissecting room, to be kept private, with doors locked and sealed during absence therefrom; also new glass, porcelain, and other vessels; likewise pure chemicals. That matters might arise involving more time than anticipated at the outset; that either the district attorney or one of his associates would have to be instructed in the actual manipulations involved in the research. My predictions were verified as to the additional work; for, besides analyzing the entire body of the deceased, that had been buried for twelve months, and discovering arsenic in every part of it, an entire second body was analyzed to determine the question of normal arsenic, which at that time excited public attention. I was happy to state to Prof. Tidy that the presentation of the importance of just returns for such professional services was successful, not alone for this particular case,

but for subsequent ones. Thus the ancient, unjust custom was abolished in New York City. Ere long it spread through the country. I have many times been solicited by toxicological experts to express my opinion as to the justness of their charges for services rendered where their bills had been contested. I respectfully but zealously urge that the medico-legal and toxicological sections of the Pan-American Medical Congress discuss and ultimately advocate the three features in criminal poisoning cases I have taken the liberty to suggest.

THE MEDICO-LEGAL ASPECTS OF FRACTURES FROM A CONSIDERATION OF THEIR ETIOLOGY, DIAGNOSIS, PROGNOSIS, AND TREATMENT.

By THOMAS H. MANLEY, A. M., M. D., New York.

The disorganization of bone from traumatic influence, fractures, belongs to that category which may be designated as serious surgical lesions. Of all lesions of this class, fractures are by all odds the most common. Every practitioner of the healing art sees them, and all, or nearly all, are assumed to be competent to properly treat the simple types. No age, sex, or condition escapes them. In varying degrees, according to the age of the patient, general health, and character of the lesion, they always leave a defective limb. In early life nature affects her work of repair so perfectly in many, when appropriate treatment is instituted, that the patient, after adult years are attained, is scarcely conscious of any impediment in function or diminution in strength in the former injured limb. It is only when the limb is put on a severe, protracted strain, in the event of sudden changes in the weather, or as one advances into old age, that he is reminded by a sense of weakness, twinges of pain, and a tender point over the seat of injury that the integrity of the limb was ever damaged. Many types of fracture in early life, by the simplest method of treatment, undergo prompt repair, leaving no visible evidence of their presence. Others, regardless of what measures may be instituted or of what skill and experience may be brought to bear in their management, never unite by an osseous isthmus, thus shortening or deforming the limb. Although time and custom have sanctioned the division of fractures into two groups, the simple and compound, this is but an arbitrary arrangement and tends rather to confuse than to elucidate, for all fractures are essentially compound or complicated. Not a few so-called simple fractures are more difficult to manage and leave greater deformities than those designated as compound. It is not infrequently quite impossible to definitely diagnose a fracture. Many fractures extend into the neigboring articulations, or are complicated with more or less luxation. As the union of a fractured bone is effected by two distinct processes; by primary intention, without a callus; or by extensive homologous cell proliferation, with a provisional mass encircling the ends of the bones (in a considerable number as early as the second week); it may be quite impossible to say from any physical examination, without the employment of considerable force, whether or not the bone had been dissundered. In a general way, it can not be said that the antiseptic treatment of wounds has in any manner revolutionized or improved on the principles recognized for ages as appropriate in the management of simple fractures, though since Listerism and cleanliness have been introduced, osteotomy has been more freely practiced for distortions of bone and non-union, with better effects, than before they became current with the profession.

MEDICO-LEGAL QUESTIONS IN THEIR RELATION TO THE ETIOLOGY, DIAGNOSIS, AN TREATMENT OF FRACTURE.

It might seem on first thought that a question of litigation or jurisprudenc could scarcely enter into the consideration of the causation of a fracture, but ther are many cases on record in which actions in civil and criminal suits have reste mainly on this feature alone. The situation and extent of injury have not bee disputed by the defense, but they denied their responsibility by alleging that th plaintiff was injured in another manner than that represented by him or her Cases of this description are not uncommon. The inducement, by a little con nivance with the unscrupulous, to turn an accident to good account very often i very great. As individuals and corporations are almost wholly at the mercy o the surgeon, in these cases it behooves him under all circumstances, when he ha the least suspicion, to examine the patient critically for surface lesions and deman from him a full and complete account of how the injury occurred. In many th physical examination alone will not decide the quality and extent of force sus tained; whether it was direct or indirect; or whether his body came in contac with an object or whether he was struck by an object. When we remember tha fracture in rare instances may ensue from muscular violence alone, we can th better appreciate the difficulties which beset us in many of these cases in whic fraud is suspected.

It is always of prime importance in every case of fracture to investigate th patient's general condition, or at least we can casually make note of it. Is he dea or nearsighted? Is he a rheumatic, gouty, or syphilitic subject, or is he in greatl reduced general health? Has he ever been injured before; and if so in the sam limb, and how many times? Even an approximate determination as to the precis manner in which a fracture has been produced is often extremely difficult to reach It is certainly marvelous and often inexplicable how one may at times fall 50 fee or more and entirely escape injury while another may fall one-third the distance or less, and sustain multiple and grave fractures. But there are fractures whic have quite absolute and unique histories of their own, which, when we are familia with them, will not deceive us.

Typical fractures.—Fractures near the epiphyseal end, at the radio-carpal articu lation or the tibio-tarsal articulation, are usually the outcome of indirect violenc Fractures much removed above these positions are generally the outcome of forc directly applied. This is notoriously the case in fractures of any part of the shaft of the ulna or fibula, when uncomplicated. The diaphyseal center of the humerus too, is seldom broken except by the application of direct force. This generally hold good with the same anatomical structure of the femur. Apophyseal fractures are with few exceptions, the result of indirect force. The only exception to this ge eral rule would be the elbow joint of the youth. The clavicle usually fractures i consequence of indirect violence. The body of the scapula, the pelvic bones, th carpus, tarsus, metacarpus, and phalanges fracture rarely, except through crush ing force applied over them. The late Prof. Darling, of New York, used to sa that one should recognize the etiological factors in broken ribs by the directio which the fragments took after injury. He taught that when the vulnerant forc was applied directly over the costal convexities the ends broken off must need penetrate the pleura and perchance damage the pulmonary organ underneath, bu when the force was applied indirectly, as by antero-posterior pressure or by mu cular action, then the fractured ends would press outward under the integumen when the respiratory organs would escape. As fractures of the skull constitute unique and independent class of injuries, which in their physical qualities an clinical phenomena present characteristics peculiar to themselves, they will no be embraced in this review. Fractures of the spine possess no definite physical

clinical characteristics. A current impression prevails that a broken back or fracture of the spine is always a very grave injury, which necessarily must entail a permanent crippling; but this is erroneous, as a general rule, as has been repeatedly demonstrated. It is only when the cord is simultaneously damaged that paralysis succeeds in consequence of the fracture. Fractures of the spine follow direct and indirect force; the latter more frequently. When they occur as a consequence of direct concussive force, the consequences are more serious. Fracture of the lingual or hyoid bone is an exceedingly rare lesion. I have never met with one in more than 3,000 fracture cases.

In modern times, since the rapid and enormous extension of the railroad, very many are crushed or maimed by the vehicles which are rolled over them. These fractures are commonly compound when the wheels roll over the limb. But there are many exceptional cases, in which the integuments are unbroken, yet the bone has sustained extensive shattering, the neural or vascular trunks being seriously damaged at the same time. The extent of damage to the limb after having been run over by car wheels will depend on many factors directly connected with the condition of the patient, but more often with the weight of the car, whether a street car or a steam railroad car, freight or passenger, whether or not it was loaded or empty, whether one or both wheels passed over the injured limb, and whether the car was in rapid or slow motion. So many cases have come under my observation in which one or both wheels have passed over a limb on a street railway without destroying its integrity or even causing a fracture, that we certainly can no longer entertain the view that an accident of this description will always irretrievably destroy the limb. In all cases in which shamming is suspected we should carefully examine the clothing and look for abrasions, ecchymoses, or discolorations of the integument. This class of accidents seldom occurs except to young and heedless children, to those physically incapacitated, or to the intoxicated.

Steam railroad injuries of the limbs constitute practically a separate class of fractures. With these are fixed sets of symptoms seldom associated with tramway accidents. There is commonly bodily and organic injury as well as the local disorganization. This former may quite overshadow the latter in importance and gravity. It is well in all these cases to determine the extent and degree of bodily injury present in all cases, if possible, at the first examination. Another element of far-reaching importance is that of a psychological character, the element of fright and of nervous shock. It has long been noticed that when those injured on railroads are employed on them, the extent of shock is not so great as when the same degree of traumatism is borne by a passenger. A limb run completely over by the car wheel on a steam railroad of a trunk line must inevitably be greatly damaged, and in the vast majority of cases completely destroyed. I have no recollection of having ever seen a limb survive which has been rolled over by the wheel of one of those freight or passenger cars, though there are records of such injuries wherein the limb has escaped destruction. It is almost needless to say that in all this class of injuries the fractures are compound. But it is well to note that the living integument is a very tough tissue; and hence in many, while there may be but a small opening in the integument, the inclosed bone and muscle are ground to a pulp, while the main arterial trunks and nerves are completely torn through.

FRACTURE-DISLOCATIONS.

The etiology of fracture-dislocations is generally definite and simple. With the exception of machinery accidents, they are seldom if ever induced except by indirect force; but at the elbow they more commonly are occasioned through violence acting immediately over the seat of injury. The causative factors in a Colles's or a Pott's fracture are so well understood and so constant that we would regard

with suspicion a fracture belonging to either of these in which it was alleged that it had been induced by a blow or by being run over. We will very rarely, if ever, induce a dislocation by any measures which we will employ in treating a fracture; but, unhappily, the converse is not the case. The humerus is often fractured below the surgical neck in the effort to reduce a dislocation of the shoulder. Two such accidents have occurred in my practice; one in a man and one in a woman. Many years ago I saw this accident happen in Bellevue Hospital while Dr. Frank Hamilton was assisting in the reduction of the joint. In both of my cases the bones remained out of their socket. No case has come to my knowledge in which a civil action has been brought for damages after this complication has followed; and it is difficult to conceive how ground for action could be reached when ordinary precautions are observed.

FRACTURES RESULTING FROM THE ATTEMPTED LIBERATION OF ANCHYLOSED JOINTS.

All anchyloses of joints are attended with an atrophy of the muscles which act on them and the bone substance of the shafts on the proximal end of the immobilized joint. It is quite impossible in many cases to determine the nature, extent, or situation of the pathological conditions which cause the anchylosis. It may be osseous or ligamentous, intrinsic; or it may be, what is most common in my experience, caused by extensive adhesions between the muscle sheaths with degeneration, contraction, or shortening of all the flexor muscles, extrinsic. If the case be not carefully studied, its pathology fully appreciated, and force skillfully and judiciously applied, much harm may follow manipulation. The femur has fractured twice in my hands in trying to break up an anchylosis of the knee joint. In attempting the same procedure on two others I have fractured both patellæ, much to the increased strength of the limbs. In many types of knee-joint anchylosis this is a procedure which is rather a valuable therapeutic measure than a source of ultimate detriment to the limb. In fracture of a femur, when every possible precaution was employed, particularly were complications to follow the accident, the question of damages might be raised.

FORENSIC CONSIDERATIONS IN THE ETIOLOGY OF FRACTURE.

On a superficial view of the subject one might assume that the surgeon had performed his part and fully discharged his duties in a case of fracture when fair structural and functional restoration had been secured without deformity. As far as one's legal obligations are concerned, this view is correct. But, in this country and in our times, when the sanctity of an oath is indifferently regarded by many, when perjury is rarely punished, and when so many maintain themselves by resort to sharp practices, it behooves the medical attendant in the interests of justice and science to examine with great caution every case of fracture or dislocation in which he has the slightest suspicion of the perpetration of fraud. A designing person may, through a ruse, go through the farce of being injured. He may have had an old dislocation, an ununited fracture, or a deformity which may present many of the characters of an impacted fracture. Now, with a few well-coached, pliant witnesses and the testimony of a reputable practitioner, the plaintiff is in a fair way for recovering heavy damages if neglect of an individual or a corporation can be proven. It is, then, of cardinal importance that the causation be clearly established in every case of fracture which comes under our observation. But how can we determine the recency or proximate causes of a fracture in most cases?

MEANS FOR ELUCIDATING CAUSATION.

This may be accomplished by rigorous examination of our patient, both as to his general condition and as to the local condition of the parts. In every case of a fracture or dislocation, if seen within twenty-four hours, well-marked constitu-

tional disturbances are usually present. As a general rule, with very few exceptions, in all cases of fracture of the long-bone shafts or dislocation of the major articulations, the body sustains, simultaneously, more or less shock. But should evidence of this be absent, or present in only a mild degree, local phenomena of reactory inflammation are visible. There is immediately after injury a pallor of the features; the general integument is pale and anæmic; the pulse is weakened and quickened; and if we observe the patient cautiously we will notice well-marked diminution in bodily strength. Following immediately after injury constitutional symptoms are more marked and accentuated. Now we should find evidence of surgical fever, elevation of temperature, with a full pulse, and an expression of the countenance which bespeaks bodily suffering. This latter in simple fracture is not always well defined.

LOCAL CONDITION OF THE PARTS.

The age of a fracture, whether recent or of long existence, can be ordinarily definitely determined by local conditions. The same will apply to dislocations. We will first note the state of integument, as to whether it is bruised or lacerated; whether we have evidence of sanguineous extravasation or tumefaction. Abnormal mobility of the fragments, with crepitation, are unmistakable evidences of fracture. Mobility in itself gives us but little information with respect to acuteness or chronicity of a fracture. For we may see it in an old fracture and in the recent fracture it may be wholly wanting. But bony crepitus is an unerring monitor. No tongue or pen can adequately describe the tangible qualities of this sensation. That harsh grating sensation which it transmits to the hand has no parallel in any physical phenomena whatever. It must be felt repeatedly to be fully appreciated. But when we once are acquainted with it, it can never deceive us. In old fractures or dislocations, atrophic and arthropathic changes, when carefully sought for, will stamp the true character of the lesion. Difficulty is only encountered in very fat individuals, mostly females, in whom the joints and bone shafts are often covered in by dense layers of adipose tissue.

ON THE MANNER IN WHICH A FRACTURE HAS BEEN SUSTAINED.

Has the bone been fractured by muscular action or by extrinsic violence, by direct or by indirect force? A fracture of bone from muscular action alone can occur rarely, except when the elements of the bone are the seat of pathological changes, as cancer or osteomalacia, etc. The only exception to this, perhaps, is in the case of the patella. But, from my own observation, I am inclined to believe that fracture is a lesion rarely attributable to muscular action. In about 30 cases of this type which have been treated by me in none was fracture wholly attributable to this cause, but rather to indirect violence. A fracture of a shaft from muscular action I have never met. In a general way we know that in the great majority of the most common types of fracture they have a definite etiology.

We know that Colles's fracture at the wrist and Potts's fracture of the ankle are always attributable to indirect force, as are also many fractures of the lower end of the tibia, while fracture of the femur, the fibula, and the ulna most commonly occur in consequence of direct violence. This is generally true, too, of those fractures which involve the upper third of the tibia or fibula, when separately fractured, the radius, and ulna, and the humerus in any of its segments. The shafts of bone are sometimes fractured *in utero*, we are informed, but this must be a rare accident. I have never seen such a case or seen a report of one in the current literature of surgery within my recollection. Indeed, with the osseous structures yet in a cartilaginous condition, it is difficult to conceive the possibility of such a lesion except in the latter stages of pregnancy, when should such a traumatism be borne by the uterus through violence applied over it, it seems inevitable that life itself must be

seriously imperiled. It is very probable that such few cases as have been reported were those in which the bones were broken in their passage through the canal of emergence at the time of delivery. Fractures of the femur during delivery are not uncommon, but they almost invariably promptly unite and leave no trace of deformity.

FRACTURE OF BONE IN MORTAL INJURIES.

The question as to the precise date of fractures which have been found post-mortem has occupied an important position in many medico-legal cases, but as they pertain, in the greater number, to skull injuries, an extensive consideration of them is not now necessary. Ogston (Forensic Medicine, p. 5141) alleges that "the presence or absence of a blood-clot in a fracture detected post-mortem is of no definite value in determining whether a bone was fractured before or after death," and says that "the only real test is the presence of reparative processes;" and that "this, only, can the medical jurist rely on." He adds, though, that a clot found between the ends of a fractured shaft is decisive proof that it was of an ante-mortem character. In this, however, Casper does not concur. Devergie (Médecine-Légale, Vol. II, p. 101) tells us that every shaft of bone fractured completely after adult years are attained, results in a diminution of the volume of the bone, which, in the living or the dead, is easily appreciable in thin subjects, but in fat subjects, particularly women, it is not easily detected. In the absence of a well-defined callus, this, he says, is important to remember. In concluding this part on the etiology of fracture from a forensic standpoint it is well to always determine, if possible, by a thorough scrutiny into the patient's or subject's history, whether he had a predisposition to fracture, had a preternatural fragility of the bones, or had previous fracture. On inquiry in fracture cases in my hospital service, many instances have come to my knowledge in which the patient has previously fractured other bones of the skeleton. Many have come under my care in which the most trifling sort of force had broken the bone. Ogston (*loc. cit.*, p. 210, Vol. II) cites the case of a carter who, in jumping from the shaft of his cart, fractured both of the femora in their centers. He mentions another case, which ended mortally, in which but a slight blow on the shoulder so shivered and shattered the head of the humerus and upper third of its shaft that the man succumbed to it. On autopsy it was found that the bone was composed wholly of a friable, spongy tissue, with only a thin shell of compact tissue to enclose it. In all these cases, on examination, we should sedulously inquire into the patient's general condition, with a view of learning if he were in any way invalided by a preëxisting local or constitutional infirmity, as anchylosis, the wearing of an artificial limb, rheumatism, or paralysis, or any other infirmity which would in any manner interfere with locomotion, as these should each and all be regarded as indirect but important factors in the etiology of many fractures and other injuries.

DIAGNOSIS.

As previously stated, it is of fundamental importance that a correct diagnosis be reached, if possible, on the first visit. Many a medical attendant has come to grief through neglect to rigorously observe this rule. It is true that there are often many obstacles in the way at one's first visit. First, the fracture, if recent and close to an articulation, may be of such a character as to defy detection, and if many hours have elapsed before it is seen inflammatory changes, with intumescence of the adjacent parts, may be so great as to quite completely mask the indubitable symptoms. The bone may have been fractured transversely without any displacement, and the temporary muscular spasm, always present when reactory inflammation has set in, holds the fragments in firm apposition. It may be said that with many fractures their recognition is indispensable rather from a medico-

legal standpoint than with respect to treatment. Many fractures, from their situation, are extremely difficult to recognize without the aid of an anæsthetic and one or more assistants. This is particularly true of the proximal end of the femur and fractures which involve the elbow joint. A fracture of the anatomical neck of the humerus may be mistaken for a dislocation if great care is not exercised. There are types of luxation and subluxation of the radio-carpal articulation which on superficial examination present some of the characteristics of fracture, and *vice versa*. Secondly, we may encounter impediments from the patient and the environment. The patient, if a female, may, through a sense of modesty, be reluctant to permit the medical attendant to expose her in his examination. She may allege that she has but a sprain, and that such examination is not necessary. Her word may be unwisely taken and an examination not insisted on. Such a case occurred in New York very recently. The patient, an actress, had been kicked by her husband in an altercation, the blows falling on the leg and knee joint. Very great pain following, a neighboring physician was called in, who hastily examined her limb under her garments. He prescribed a liniment and made light of the case. Later, another physician was called, who detected a fracture of the patella with some inches of separation of the fragments. I was invited in to verify the diagnosis. A civil action was instituted against the first medical attendant, through which a verdict was found for the plaintiff. One may be called late in the night, far away from associate medical aid, or to one wholly unable or unwilling to pay the expenses of a consultation. Our patient may be hypersensitive, intoxicated, boisterous, or unmanageable, but the law holds us equally responsible for all. In large cities and populous towns there is some relief for us in these cases by sending them to a hospital, but in small villages and scattered country sections we generally can not shift the responsibility. Most of our mistakes in fracture diagnoses arise from haste or an imperfect knowledge of the anatomical and physical qualities of the lesion. A few years ago a vigorous young laborer came to me to attend him for a fractured clavicle. He had a few hours before been at one of our most noted dispensaries, and the shoulder was already firmly adjusted by a modified Sayre's dressing and enveloped in several deep layers of a copious dressing. But he had great pain and demanded a redressing. I sent him back to the dispensary from whence he came, reminding him that most public dispensaries are schools for instruction and that what he got for nothing must be generally valued accordingly. In a little while he returned again, begging me to examine the distrained joint. He had been at the dispensary, but besides nicking the edges of the dressings with scissors nothing had been done. On removal of all the dressings, I discovered no injury of any description. We can well imagine the consequences to a healthy limb and articulation in such a harness for six or eight weeks. An elderly woman, out marketing one winter night, slipped on the curbstone of a sidewalk and was unable to rise. An ambulance was called, and she was entered in the surgical ward of one of our principal hospitals. The house staff, wearied after a heavy afternoon clinic, made a hurried examination, pronounced her case one of fracture of the head of the femur, and put the limb up in a Buck's extension apparatus. She was informed that she must keep the bed for six or eight weeks and that she would be lame for the remainder of her life. Her friends sought her out, and, in spite of the protests of the doctors, brought her home the same night. At about midnight I was called, and on examination discovered that there was no fracture of any kind, but a dislocation of the head of the femur backward on to the dorsum ilii. With the employment of a strong clothesline and three strong young men, boarders in the house, I was able to readily reduce the displaced bone. In two weeks she was about as usual with scarcely a perceptible limp. In doubtful cases of fracture we should always insist on a consultation or advise the patient of our doubt. Then, should

deformity occur, we are not responsible for it or the error through which it exists. Surgeons and practitioners are sometimes called in after a case has been under the care of another practitioner, and in which possibly it may be alleged that there was no fracture, but that the practitioner had tried to "make a case" of it with a view of extorting a fee or aiding the patient to secure damages for a spurious injury.

In this connection it is important to inquire: Are there any physical evidences during life by which we can determine whether or not there has been a fracture sustained when we can only examine the limb one or more weeks after the alleged injury? In the case of a fracture of the femur or humerus in an adult, it is my conviction that imposition is rarely possible. But in any simple fracture in a growing child, or one which involves the tibia, fibula, radius, or ulna of an adult, after the first week there are no means known to art by which we can determine this question with definite certainty. It has long been known that bones, like the soft parts, unite by two processes, primary union and secondary union. In the latter we always find a callus; in the former not necessarily. This has been repeatedly demonstrated in my own practice in cases in and out of hospital. Within the past year a case came under my observation in which a gentleman had injured his right leg, and the question arose as to whether or not he had a fracture. He had been injured nine days before I saw him. The attending physician had called in one of our best-known surgeons, who decided that he had a fracture in the lower third of his leg. At my request the plaster dressings were removed in order that I might examine the under limb. The patient persistently protested that he had no fracture. I could certainly discover no positive evidences of any; but nevertheless, knowing the respectable character and high attainments of the former consultant, besides bearing in mind those occasional cases of primary union, practically non-calloused fractures, advised the family that there had been a fracture and recommended the removal of the plaster cast, now rendered unnecessary. In a simple fracture case in a young man, in the event of a litigation over a case, the defendant is often quite at the mercy of the medical attendant. Therefore the practitioner who would uphold the honor of his profession and refuse to be an accomplice to a crime must exercise great caution that he does not prematurely designate a sprain a fracture, and thereby work very serious injury against an innocent party and strike at the very foundation of civilized society by committing a felony. On the contrary, he must be vigilant; that he does not designate a fracture a sprain because there is neither pain, deformity, or loss of motion. It is an humiliating admission to make, but truth and justice demand it; and hence it must be confessed that of late years many cases have come to my knowledge in which no severe bodily traumatism of any kind had been borne, in which "worked-up cases" of fracture had been pressed for no other purpose than extorting money. Those heavy accident insurance and tontine societies are great inducements to dishonesty and extortionate practices. Indeed, a case came to my knowledge within the past winter (1893) in which a physician was approached by a gentleman who had been his former patient, and informed by him that he was carrying a heavy accident policy, which would pay him $50 per week, in the event of accident, for ten weeks, adding that he was then in straitened circumstances; and he had the audacity to ask the doctor if, for a consideration of $50, he would splint his arm and treat him for a pretended fracture of it, so that he might raise some money from the company on a medical certificate.

DIAGNOSIS OF COMPLICATIONS ATTENDING FRACTURE.

It is well to remember that in most fractures resulting from violence simultaneously with the bone disorganization there is severe bodily shock, and possibly other structural organic lesions, resulting from the same influences. This is partic-

ularly true of railroad and machinery injuries. There may be a dislocation with the fracture or there may be fracture of other bones, notably of the skull or ribs. In recent times spinal shock or concussion of the spine is not infrequently said to attend as a complication of fracture. In all those serious cases, in the interest of all parties, it is an imperative duty that a minute scrutiny of the entire body be made at the primary examination or as soon as the patient is in a condition to safely bear it.

PROGNOSIS.

A clear conception of the causes of a fracture, with a comprehensive knowledge of its type or character, opens the way to a reasonably safe prediction as to immediate and remote results. Very often when called to attend one suffering from a broken bone we are persistently importuned by the relatives or friends of the patient for an opinion, or an assurance, as to the ultimate utility of the limb after treatment is ended. Here we must exercise great tact not to compromise ourselves by too optimistic promises, nor on the other hand by too somber insinuations to unduly discourage or alarm. To commit the former would be to leave us open to severe censure or a prosecution in the event of disappointment, and the latter might cause us the loss of the case, very much to the detriment of our doing a village or country practice. The succeeding practitioner, though perhaps fully realizing the serious character of the injury, would inspire his patient and those about him with hope, and yet hedge in such a way as to escape criticism.

Every one, from the meanest to the highest in this world, by an instinctive impulse, will invariably endeavor to minimize or conceal their infirmities, and the fractured invalid is no exception. An intimate familiarity with the clinical history and sequelæ of each individual case will usually warrant us in venturing an opinion after the fracture has been definitely recognized. We will be guided in the main by the age of the patient, the condition of general health, the nature and situation of the lesion, the absence or presence of complications, the facilities for treatment, etc. But in no case can an absolute opinion be vouchsafed, inasmuch as we know nothing about our patient's peculiarities, for a bone may fail to unite, the soft parts will not bear protracted pressure, anchylosis, shortening, deflection, wasting of the limb, gangrene, or persistent weakening in the limb may follow. These are unusual but possible sequelæ in the hands of the most experienced. No one will be rash enough to promise anything approaching perfect functional or structural restoration in a fracture which involves an articulation, or one opening into the elbow joint, an intracapsular fracture at the hip joint, a Pott's or a Colles's of the ankle or wrist joints, nor will he forget to remind his patient of a probable shortening in every type of complete femoral fracture at any age. But we may say in all cases of fracture of every description that a defective limb will always follow any line of treatment. This we may always maintain from the fact that normal, histological bone, once destroyed by either disease or trauma, is never reproduced; that the substitute which nature provides for repair, while fulfilling, in a large measure, the functions of the damaged bone shaft, is yet but a species of ossified cicatricial tissue without the vitality, strength, or resiliency of what it has replaced. We may add, too, that the younger the patient the better the prospect of functional restoration; while, on the contrary, in those at or past the meridian of life anything like perfect restitution is out of the question and permanent weakness must remain.

TREATMENT.

The surgical therapy of fracture has been the rock which has wrecked many an unfortunate practitioner. In past years in the United States a considerable number entered at once into active general practice with little or no practical experience in dealing with traumas. Clinical knowledge was not an essential requirement

for a medical degree, and hence when the surgical tyro was called to his first case of a seriously complicated fracture very naturally his patient's escape from death, the loss of his limb, or a deformity might be attributed to good luck as much as to the skill and experience of his medical attendent. The law does not expect impossibilities, but it does demand of those who practice the healing art as general practitioners that they possess a reasonable knowledge of the principles which underlie it and their application; that one is acquainted with the plan of treatment called for in those cases which he assumes to manage. Of the specialist in any line of practice, whose fees are larger, much more is demanded, and his responsibility is greater. Very naturally when one has confided the management of his shattered, distorted limb to our care it is presupposed that he authorizes us, as far as is within our power, to provide every possible resource of art and science to restore the usefulness of the limb. Therefore, as many complicated and serious fractures possess unique and peculiar features, as a preliminary step of cardinal importance, in all of these cases, a consultation should be insisted on. The last thirty years has witnessed a revelation in the treatment of fractured limbs, and accordingly what were laid down as orthodox measures in the recent past will not hold now, though it must be admitted that the fundamental principles of fracture therapy yet remain. Change has been rather in the direction of detail than the adoption of new principles, except in compound fracture. Tenotomy, the extended posture with traction weights, the gypsum dressings, resection of bone as a substitute for primary amputation, all belong to modern times, none of which would have been possible without the inventions and discoveries of which these are the legitimate outcome. Accordingly it might be fairly asked if the physician had done full justice to his patient who had not utilized all the materials and facilities which modern science has rendered accessible. Right here is wherein the difficulties arise. For it might be inquired, Have all these innovations in fracture-treatment been in advance of measures formerly in vogue?

It is perfectly rational to inquire if it is a prudent plan to fix a fractured limb in any sort of immovable dressing immediately after injury.

Is the extended position, with weights or not, a gain over postural treatment, or muscular relaxation with flexion? Is plaster of Paris, in a general way, more conducive to simplicity of treatment than the older custom of segmented splinting? Is tenotomy a measure which may be generally adopted in cases of extreme rigidity and overriding of the fragments? Considerable difference of opinion prevails among the most eminent authorities at the present day on these questions, which is an evidence that none of them carry the force of dogma. It is in one's experience to now and then be called to a case in which, for many reasons, it is inexpedient to call a consultant. The patient injured is in no great pain, but it is quite impossible to say whether there is a fracture or not. Under these circumstances what should be our course of action? Or, should we encounter a case in which on consultation, no unanimity of opinion can be reached, what should be our line of conduct? In the former our interests will be better guarded by always applying some sort of temporary adjustment and watching the case until time will decide. In the latter the opinions of the majority should prevail, if there be a third party; at the same time the injured party and relatives should be candidly informed of the difference of opinion. Many practitioners have come to grief by an overconfidence in their own capacity and knowledge, by an unskillful, imperfect or hasty examination. The classical symptoms of fracture are wanting; the hypersensitive patient resists forcible manipulations, without which the definite recognition of certain fractures at certain times is utterly impossible. The patient will vehemently proclaim that he has no fracture, because "he can move his fingers or toes." A simple lotion is perhaps prescribed and the case dismissed. Possibly nothing more is heard from the case until the first medical

attendant is served with a notice of a suit; when abundant expert and other testimony is forthcoming to incriminate him for the neglect through which the patient suffered in consequence of unskilled, protracted treatment, or perhaps now he has a deformed limb. Malpractice essentially consists of two phases. First, the passive, in which one's course is not sustained by general authority. Second, when those measures in treatment are omitted which might have approximated to secure perfection in results. Very naturally those fractures which lie close to or involve the joints, and those which engage the major shafts, are the class which most often are attended with unsatisfactory results; and hence the subject of malpractice suits. Fractures when improperly treated, or when they occur in patients of unsound health, may terminate in (*a*) non-union; (*b*) deformity; (*c*) anchylosis; (*d*) muscular atrophy; (*e*) shortening, or (*f*) gangrene.

Non-union.—There are no means known to art by which we can predict non-union or prevent it in many cases; hence, we can not be censured for failure of union when our treatment has been on the right lines.

Deformity.—While, as a rule, particularly in the young, deformity can and should be prevented, in the adult, in certain types of fracture, its suppression is often quite impossible.

Anchylosis.—Muscular anchylosis is a general sequence of all fractures, and shortly disappears. Arthritic anchylosis is the phase which most commonly disables the injured and leads to lawsuits. It is well to bear in mind that in even the most aggravated types of this, use of the limb and time practically overcome it; more so, it is true, in some joints than in others.

Muscular atrophy.—Atrophic changes in the soft parts follow all fractures. But it is only when muscular wasting is persistent and permanent that complaint is heard. But it must be a very rare event, as I have never seen a case of that exaggerated type of trophic destruction of muscle mentioned in the text-books. As acute temporary atrophy is always a curable affection after fracture, it is quite inconceivable how its presence could be made the pretext for litigation.

Shortening.—Moderate shortening is a usual event in many fractures; hence it is only when the reduction in length is excessive that it can afford a pretext for damages, and even then, with young, restive patients, or those ungovernable to treatment, no fault can attach to the medical attendant.

Gangrene.—But few cases of gangrene have come under my care in fracture cases; but five, as nearly as I can remember, in all. It must be admitted that it occurred through too tight bandaging. With the exception of one, it occurred under the gypsum bandage. In three the limbs had to be sacrificed. This is an accident which, while the most deplorable, is fortunately the most rare. My impression is that a limb is seldom lost in a simple fracture from gangrene or asphyxiation of the tissues except through ignorance or carelessness on the part of the medical attendant. In considering the treatment of fracture from a forensic standpoint, a regional division of the body may somewhat simplify its study.

THE UPPER EXTREMITIES.

Shoulder joint.—Fractures which involve the anatomical neck of the humerus have been mistaken for dislocation. The epiphyseal disk sinks under the deltoid, and the shaft is greatly displaced by muscular action. A violent blow on the shoulder may paralyze the arm, occasion a fracture or dislocation. Only a most careful examination will always enable one to differentiate in this event. In any case, if in doubt, a consultation should be requested and an adjustment applied. Civil actions seldom arise in consequence of fracture through the center of this humeral shaft, but as we approach the insertion of the digital muscles and the anchyloid ridges the case is different.

Elbow joint.—As the elbow joint is a complicated articulation, any fracture which extends through the condyles and opens the humero-ulnar articulation may be serious in its consequences as far as the future flexibility and strength of the joint are concerned. A wide difference of opinion yet prevails in the details of treatment of this lesion, so that there is a loophole for escape in the event of suit. Some authors recommend the straight position, the arm extended; others want it flexed. Again, one would have passive motion commenced early; others would have it begun only after union is effected.

Wrist joint.—As fractures which occupy the middle of the shafts of the radius and ulna usually unite well under ordinary treatment with the application of general principles, those which sunder the bone near the radio-carpal articulation may be now considered. It can not be said that there is a very wide diversity of opinion in the treatment of a typical Colles's fracture; probably for the reason that in spite of any line of treatment adopted more or less impairment in motion, deformity, and anchylosis remain. This was my position in an essay read last October before the New York State Medical Association. But issue was taken with me, and some went so far as to affirm that by an appropriate therapy good results should be always secured. Valentine Mott, writing twenty-five years ago on this, said in a communication which was used as testimony in court in a malpractice case (McClelland, on Malpractice, p. 203), "fractures of the radius anywhere from 2 to 3 inches of the wrist joint, even when treated by eminent surgeons, are often very difficult of management so as to avoid all deformity; indeed, more or less deformity may occur under the treatment of the most eminent." Nevertheless, of all joints in the body there is none, perhaps, in which good or indifferent results are more dependent on treatment in fracture above it than this. Not that we can make it perfect, but appropriate treatment will avert many unpleasant consequences.

LOWER EXTREMITY.

Fractures, intra and extra capsular, at the hip joint.—Intracapsular fractures at the hip, as they mostly occur in the old and seldom unite, are not often the subject of civil actions for malpractice. The fragments rarely unite, not because there is any good anatomical reason for failure in this direction, but because it is impossible to rigidly confine the patients in the dorsal decubitus. Extracapsular fractures are uncommon at the hip, and are usually amenable to ordinary treatment. The battleground has been in cases of fracture of the shaft of the femur. The femur is a difficult bone to manage in fracture. Its principal muscular envelopes hold the distal fragment in a vicious grip, which is only overcome when dangerous pressure is exercised on the soft parts. Can we secure union here without shortening? Mott again speaks on this subject[1] (*ibid.*), and says that "more or less shortening is uniformly the result after fracture of the thigh under the most fortunate circumstances." On the same occasion Dr. Alfred C. Post stated that "the injury of the soft parts would interfere with extension of the limb," and that he had "personal knowledge of two cases in which the attempt to make extension and counter extension resulted in mortification," and that "the thighs had to be amputated." Mr. C. B. Keetley, of London, in a recent able contribution ("On the Prevention of Shortening and Other Forms of Malunion After Fracture," London Lancet, June 10, 1893), says:

It is well known that surgeons of great eminence and high character have claimed uniform success in treating fractures of the femur without resultant shortening; but I think the trenchant criticism of these claims, given in Hamilton's Treatise on Fractures, that they have not been made out, and are not to be trusted, etc., is just. * * * I will venture to take it for granted that serious shortening occasionally follows fracture of the femur, treated however carefully by all methods hitherto described.

[1] —— *vs.* Oatman.

Of late years fracture of the femur has been chiefly treated either by the gypsum cast or by extension in the United States. Dr. Lewis A. Sayre was a warm partisan of the plaster dressing, claiming almost uniform good results without shortening. He lays the law down as to the principles of extension, fixation, etc., which are all very well in theory, and long known as fundamental in surgery, but which are utterly impracticable in the majority of cases. Dr. Frederick Hyde reported 308 cases of fracture of the femur, which were treated in Bellevue Hospital from 1868 to 1873, inclusive, in which the average shortening in all cases (the perfect and others) was half an inch.

In the years 1872 and 1873 the late Frank Hamilton and Lewis A. Sayre reported their results separately, Sayre employing plaster dressing with almost no shortening, if any. Hamilton's cases were treated with Buck's extension. He confessed to having shortening as a rule. Sayre's tables bear the traces of an enthusiast, for in the column of results there is an apparent evasiveness of detail as to deformity or shortening, while the successes are submitted in detail. (A Record of Fractures Treated at Bellevue Hospital with the Plaster Apparatus, from April, 1871, to April, 1872.) Dr. F. Hamilton's tables of results in fracture treatment, revised and completed by McClelland, presented to the American Medical Association in 1856, though a unique and exhaustive résumé of the subject, is of little or no statistical value, for the reason that they are drawn from widely scattered sources and are necessarily inaccurate, because of the difference of interpretation in analysis of results. For instance, one author may affirm that he has a perfect result, after the fracture of a femoral shaft, if his patient showed no lameness. On the contrary, another would fail to realize perfection unless perfect length were restored. Now, Velpeau taught that there is never any limping when the shortening does not exceed three-fourths of an inch. (Leçons sur Des Fractures, p. 211.) Liston said that it should be borne in mind that there have been fractured limbs released from splintings at the proper time, of the proper length, free from deformity, which have, nevertheless, soon after become bent and shortened. (Liston's Elements of Surgery, 555.) It may then be laid down as a rule that shortening is the common result after fracture of the femoral shaft, and full restoration of length the rare exception.

Fractures at the ankle joint.—Simple fracture of the shaft of the tibia or fibula, or both, is of common occurrence; and except in unusual instances, from censurable neglect generally, does it become the subject of malpractice suits. But those oblique fractures in the lower third of the tibia and that type designated Pott's are difficult to treat, and are often followed by deformity and a defective joint action, regardless as to how they are managed. I have never seen a genuine Pott's fracture so treated but some deformity remained. Percival Pott himself, as well as Dupuytren, both distinguished authorities on fracture, regarded that fracture luxation, with fracture of the internal malleolus at the lower third of the fibula, with extensive laceration of ligament and tendon, and dislocation, as always a very serious affair. Certainly in this, as in all other types of fracture, as a general rule, the results will be commensurate with the skilled attention bestowed.

THE QUESTION OF DRESSINGS AND MECHANICAL ADJUSTMENT.

Of late years a considerable number of practitioners have had to sustain malpractice suits in which the dominant question at issue has had reference to the materials employed and the time at which definite adjustment is made. Since the introduction of plaster of Paris the treatment of fracture has undergone a revolution. That it has greatly simplified its treatment goes without saying; but that its employment is safe and the results are as good as treatment by the older methods is not by any means yet settled. My own experience entirely coincides with that of a modern author, and I am in entire accord with his views. McClel-

land (Malpractice Suits, p. 176) says: "Plaster of Paris as a primary dressing requires large experience, inasmuch as it is likely to be followed by the same bad results that so frequently follow the use of the primary or initial bandage. It is not yet the *sine qua non* so long and anxiously looked for by surgeons in the treatment of fracture. The other forms of so-called immovable dressings are just as objectionable for the same reasons. As a secondary dressing after the primary is removed, and as a dressing for compound fracture, it is highly satisfactory; and for hospital practice, where it can be seen every few moments, and be under the eye of the house surgeon or a nurse familiar with these injuries, it may be employed with good results. The surgeon who applies it to his patient 10 or 12 miles away does so at great peril to his patient and himself."

Dr. Lewis A. Sayre was a warm advocate of primary plaster dressings. In my own time of interneship, in 1875 and 1876, it was the routine practice to envelop the freshly fractured bone at once, on entrance, in wet plaster bandage. It was a vicious, cruel, and destructive practice, but it was all the rage then, and he who neglected to employ it thuswise was an "old fogy," or was not up in progress. But gangrene so commonly followed, or anchylosis, shortening, and deformity, that its primary employment is generally discarded now, though the theory died hard before surgeons would open their eyes to its dangers. Plaster of Paris brought with it a change in the attitude of the limb and introduced a new principle of treatment into fractures. With its employment the limb must be extended and the joints locked immovably. The principle of muscular relaxation and postural methods were necessarily cast aside. The old-time fracture box was thrown out as a relic of barbarism. But, with these innovations in simple fracture treatment, it yet remains an open question whether they have constituted real progress or not. Every individual case of fracture constitutes an entity in itself; therefore to attempt to generalize any form of treatment as applicable to all is worse than folly. Hence, with the exception of very aggravated and unusual cases, no blame should attach in a given case because certain special details in treatment were not carried out by the medical attendant. The treatment of fracture in respect to the time of "setting" the bone has been radically changed of late years. In the beginning of the present century, and for some time after, it was the common custom to delay splinting the limb for some few days after fracture. John Hunter taught that splints should not be applied until after all inflammation had subsided (Hunter's Surgical Lessons, p. 177), while Chelins advised a primary, fixed dressing only in oblique fractures and those which involve the collar bone, and directed that for the first three or four days nothing should be done except to lay the limb on a pillow in such a position as will give the patient the greatest ease and soothe the irritable muscles (Chelins, p. 555). I have recently set forth in a brochure published (At What Date Should Permanent Dressing Be Applied after Fracture; Practice, Richmond, Va., April, 1893) my views on this question and cited cases which have come to my knowledge in which suits for malpractice have been instituted; in one set in which it was alleged permanent fixtures had been applied too early; in another in which judgment had been given because the medical attendant had been tardy in applying rigid fixtures. The fact is that at the present time the tendency is to apply permanent fixtures too indiscriminately as a primary measure. Indeed, there can be scarcely a doubt but that the most disastrous consequences we ever see in fracture often ensue from rigid, unyielding dressings over the freshly mutilated parts prematurely applied. It is better, then, to err on the side of safety; wait until the circulation is reëstablished and all violent inflammatory reaction is past; then so adjust the limb that the patient will secure the greatest comfort with the best promise of good results. If the doctrine of rigid immobilization would hold, there might be some justification for the immediate adjustment in a permanent fixture of all simple fractures; but it will not,

for anyone of experience knows that moderate intermittent motion in a fractured limb often rather favors than hinders osseous consolidation. It is a mooted question among many of our most eminent authorities whether in many types of fracture any sort of splinting is ever of any service, as in intracapsular fracture at the hip joint and impacted Colles's fracture in old people. From a forensic standpoint it must necessarily be an extremely difficult question to answer in many instances as to just what is the most judicious line of treatment to adopt, which is censurable or which is not, particularly when one must decide without having seen the case as an expert.

TREATMENT IN COMPOUND FRACTURES.

So great and rapid have been the advances in the treatment of compound fracture within the last two decades that, when properly managed, many lives and limbs are spared which were formerly sacrificed, distortions obviated, inflammation, necrosis, and mortification prevented. Painless and aseptic, skillful manipulation of mangled parts, a more intimate knowledge of pathological changes, with the mechanical aids and perfected dressings at our command, have each and all contributed toward bringing the treatment of compound fractures to well-nigh a state of perfection. Any tyro of common sense may treat a simple fracture. Handy old men have been efficient "bone-setters," but for the intelligent management of compound fractures at the present day special skill is imperative. Many a smashed, temporarily asphyxiated limb, which in years gone by would be promptly condemned to the amputating knife, must now be saved. The medical attendant should not only be familiar with all the principles of treatment of these cases on modern lines, but he should also be ready to do such osteoplastic operations as the case may require during the progress of the cure. To do anything less is an injustice to one's patient and leaves us open to a civil action. Statistics tell us that the mortality in the treatment of compound fractures under modern methods has fallen from 60 to less than 5 per cent. It may be added that the proportion of limbs spared and made useful is equally large. And along with all this, one of the most salutary and beneficent features is the enormous diminution of human suffering. The responsibilities of the surgeon in serious compound fractures are always great; therefore, to do full justice to his patient and protect himself, he must redouble his vigilance and throw around his patient and himself such safeguards as will redound to the welfare of both.

In the foregoing notes extensive reference to the historical part of the subject has generally been purposely omitted, my aim having been rather to present what would seem to be the safest lines on which the whole question of fracture should be regarded when the question of malpractice may arise and the means which one should employ to protect himself in all cases of this description. There are fractures of many other bones of the body which often entail lawsuits, particularly those of the skull, clavicle, and ribs; but in the present brief notes it was found impracticable to incorporate them. Members of our profession, as a rule, should discourage as far as possible suits for malpractice. Without the connivance and encouragement of practitioners their successful prosecution is rarely possible. So that, unless a case presents evidence of positive criminal carelessness or total want of skill, we should not give them our support.

EXPERT AND OPINION EVIDENCE.

By CLARK BELL, Esq., of the New York Bar.

There has been so much confusion and conflict in expert testimony: so much discussion and difference of opinion as to the true province of the medical expert, especially in homicidal cases, and the subject has become so involved in the minds of medico-legal jurists that I have felt that a carefully prepared and reliable statement of the present state of the law in America and in England would be of value to both professions of law and medicine. The completely equipped medico-legal jurist, whether a lawyer or a medical man, should be advised of the state of the law upon the particular specialty upon which he is to be examined, concerning which he is to give testimony, and I have prepared with care the presentation of the law as it now exists, with a very full reference to the authorities upon each branch examined, for the use of lawyers, medical men, and medico-legal jurists generally, who are called as experts or to give expert opinions or medical evidence, and to enable them to clearly understand and reliably ascertain the real issues in such cases and the admissibility and bearing of expert testimony upon them. In editing the American edition of Taylor's Medical Jurisprudence last year I gave to both professions upon this and similar medico-legal questions the authorities in our country and in England upon which the law stands, and I draw upon my labors in this branch of that work for much of the present paper.

I.—EXPERTS.

An expert is one who has made the subject upon which he gives his opinion a matter of particular study, practice, or observation, and he must have a particular and special knowledge upon the subject concerning which he testifies. (Page *v.* Parker, 40 N. H., 59; Jones *v.* Tucker, 41 N. H., 134; Heald *v.* Thing, 45 Me., 392; Mobile Life Ins. Co. *v.* Walker, 58 Ala., 290; Slater *v.* Wilcox, Barb. N. Y., 608; Dole *v.* Johnson, 50 N. H., 454; Hyde *v.* Woolfolk, 1 Iowa, 159; State *v.* Phair, 48 Vt., 366; Nelson *v.* Sun Mutual Ins. Co., 71 N. Y., 453–460; Vander Denckl *v.* Helluson, 8 M. G. & S., 812; Bird *v.* State, 21 Gratt. (Va.), 800; Dickinson *v.* Fitchburgh, 13 Gray (Mass.), 546, 553; Nelson *v.* Johnson, 18 Ind., 334; Estate of Toomes, 54 Cal., 514; Travis *v.* Brown, 43 Pa. St., 12; Buffum *v.* Harris, 5 R. I., 250.)

II.—EXPERT EVIDENCE.

1. Expert evidence is that testimony given by one expert and specially skilled in the subject to which it relates or is applicable; concerning information beyond the range of ordinary observation.

2. The general rule of law is that witnesses must testify to facts and not to opinions. (Clark *v.* Fisher, 1 Paige (N. Y.), 171; s. c. Am. Dec., 402; Neilson *v.* Chicago, etc., R. Co., 59 Wis., 516; Watson *v.* Milwaukee, etc., R. Co., 57 Wis., 332; McNiel *v.* Davidson, 37 Ind., 336; Pindar *v.* Kings Co. Fire Ins. Co., 36 N.Y., 648; Bass Furnace Co. *v.* Glasscock, 82 Ala., 452; Heath *v.* Slocum, 115 Pa. St., 549; Amer. and Eng. Enc. of Law, Vol. 7, p. 495, note 1.)

a. The witness must only state facts and not draw conclusions or inferences from facts. (Luning *v.* State, 2 Pin. (Wis.), 215; s. c. Chand. (Wis.), 178; s. c. 2 Pin. (Wis.), 285; s. c. 1 Chand. (Wis.), 264; Abbott *v.* People, 86 N. Y., 460; People *v.* Murphy, 101 N. Y., 126; Sloan *v.* N. Y. Cen. R. Co., 45 N. Y., 125; Campbell *v.* State, 10 Tex. Ct. of Appeals, 560.)

b. It has been held that to allow witnesses to draw conclusions from facts or inferences is to usurp the province of the court or jury, and is illegal. (Booth *v.* Cleveland Rolling Mill Co., 74 N. Y., 15; s. c. 11 Hun, 278; Allen *v.* Stout, 51 N. Y., 668; Campbell *v.* State, 10 Texas App., 560; *In re* Sale of Infant Land, 6 C. C. Greene (N. J.), 92.)

III.—EXCEPTIONS TO THE GENERAL RULE.

While these are the general rules of law, there are exceptions where the opinions of skilled experts may be taken as before stated (*supra*, 3 *a–b*).

a. In cases of necessity, where it is impossible to make the court and jury understand the matter in controversy without it.

b. To inform the court or jury as to physical laws or phenomena, which practice dates back to the old Roman law. (L. 8, Sec. 1, XL; L. 3, Sec. 4, XI 6. And this has been followed in France: 2 Beck's Med. Juris., 896. And in England in analogous cases: 9 Henry, 7, 16; 7 Henry, 6, 11; Buckley *v.* Rice, 1 Plow, 125.)

c. To show the results of voluminous facts collated by a competent person who has examined and is shown to be competent to make the deductions. (Burton *v.* Driggs, 20 Wall. (U. S.), 125; Von Sachs *v.* Kretz, 72 N. Y., 548; s. c. 10 Hun (N. Y.), 95.)

IV.—OPINION AND OPINION EVIDENCE.

Opinion evidence is the conclusions or opinions of witnesses concerning propositions based upon ascertained or supposed facts, by one who has had superior opportunities and greater knowledge than the ordinary person or witness to judge of the subject-matter of the inquiry, and who, by reason of his especial knowledge of and experience with the subject, is believed to be capable of arriving at a better and more reliable conclusion and judgment, from facts within his own knowledge, concerning the questions involved in the inquiry or controversy.

a. Any witness not an expert, who personally knows the facts, may give an opinion in a matter regarding skill, after having stated the facts on which he bases his opinion; or as to matters with which he is especially acquainted, or has personal or peculiar knowledge, but which cannot be exactly or specifically described to the court or jury. (Indianapolis *v.* Huffer, 30 Ind., 235; Doe *v.* Reagan, 5 Blackf. (Ind.), 217; s. c. 33 Am. Dec., 466; Wilkinson *v.* Moseley, 30 Ala., 562; S. & N. Ala. R. Co. *v.* McLeudon, 63 Ala., 266; Chic., etc., R. Co. *v.* George, 19 Ill., 510; Willis *v.* Quimby, 11 Fost. (N. H.), 485; Elliott *v.* Van Buren, 33 Mich., 49; s. c. 20 Am. Rep., 668; Culver *v.* Dwight, 6 Gray (Mass.), 444; Irish *v.* Smith, 8 S. & R. Co. (Pa.), 537; Cole *v.* State, 75 Ind., 511; Wharton's Evidence, section 512; Stephen's Evidence, 103; Porter *v.* Requonnoe, etc., Co., 17 Conn., 249; Curtis *v.* Chic. R. R. Co., 18 Wis., 312; Bennett *v.* Mehan, 83 Ind., 566; Ceru *v.* Doudican, 114 Mass., 257; State *v.* Folwell, 14 Kan., 105; Alexander *v.* Jonquill & Sterling, 71 Ill., 366; Blake *v.* People, 73 N. Y., 586; Bradley *v.* Salmon Falls Mfg. Co., 30 N. H., 487; Ray *v.* State, 50 Ala., 104; Raisler *v.* Springer, 38 Ala., 703; Aulago Co. *v.* Davis, 32 Ala., 703; Pook *v.* State, 62 Ala., 237; State *v.* Babb, 76 Mo., 501; State *v.* Miller, 53 Iowa, 84.)

b. An expert physician may testify concerning the health of a certain person whom he knows personally, or has treated, and so may any witness not an expert, as to facts within his knowledge and observation, regarding the health or physical condition of another, or whether he was or had been apparently in good health. (Louisville, etc., R. Co. *v.* Wood, 12 N. E. Rep., 572; same Plff. *v.* Falery, 104 Ind., 409; Van Deusen *v.* Newcomer, 40 Mich., 120; Tierney *v.* Minneapolis, etc., R. Co., 24 Amer. L. Reg., 660; Higbie *v.* Guardian Mut. Life Ins. Co., 53 N. Y., 603; Smalley *v.* City of Appleton, 35 N. W. Rep., 729; Hanly *v.* Merrill, 56 N. H., 227; Cousin *v.* Sturtivant, 117 Mass., 122; s. c. 19 Amer. Rep., 401; Wilkinson *v.* Moseley, 30 Ala., 562; Barker *v.* Coleman, 35 Ala., 221; Carthage, etc., Co. *v.* ———, 102 Ind., 138; Evans *v.* People, 12 Mich., 27; Irish *v.* Smith, 8 S. & R. (Pa.), 573; Elliott *v.* Van Buren, 33 Mich., 49; s. c. 20 Amer. Rep., 668.)

c. A physician or surgeon, shown to be competent, may give his opinion as to the probable effect of wounds and injuries, after he has viewed the body and examined the wounds, and as to whether the wounds or injuries would produce

death. (Montgomery *v.* Scott, 34 Wis., 338; Batten *v.* State, 80 Ind., 394; McDaniel *v.* State, 76 Ala., 1; Noblesville, etc., Gravel Road Co. *v.* Ganse, 76 Ind., 142; Davis *v.* State, 38 Md., 15; State *v.* Crenshaw, 32 La. Ann., 406; Armstrong *v.* Town of Ackley, 71 Iowa, 76; Rash *v.* State, 61 Ala., 16; Doolittle *v.* State, 93 Ind., 272.)

d. A non-expert can not testify as to the effect of wounds or injuries.

e. Physicians shown to be qualified may testify and give opinions.

(1) As to the cause of death of a person. (Boyle *v.* State, 61 Wis., 349; Eggler *v.* People, 56 N. Y., 642; State *v.* Clark, 15 S. C., 403; Citizens' Gas Light Co. *v.* O'Brien, 118 Ill., 174; Sullivan *v.* Cowen, 93 Pa. St., 285; Boyd *v.* State, 14 Lea (Tenn.), 161; Comin *v.* Piper, 120 Mass., 188; Eidt *v.* Cutler, 127 Mass., 523; State *v.* Cross, 68 Iowa, 180.)

(2) In malpractice cases, as to whether the treatment complained of was proper. (Quinn *v.* Higgins, 63 Wis., 664; Kay *v.* Thompson, 10 Am. L. Reg. (N. Brunsw.), 594; Boydston *v.* Gittner, 3 Oregon, 118; Williams *v.* Poppleton, 3 Oregon, 139; Wright *v.* Hardy, 22 Wis., 348; Mertz *v.* Detweiler, 8 W. & S. (Pa.), 376; Roberts *v.* Johnson, 58 N. Y., 613.)

(3) In cases of rape, after an inspection and examination of the parts as to health, physical condition; and from the condition, whether there had been an actual penetration, the capacity of the defendant to resist, and the effect the crime would produce upon the sexual organs. (State *v.* Smith, Phill. (N. C.), 302; State *v.* Knapp, 45 N. H., 148; Woodin *v.* People, 1 Park. Crim. Case (N. Y.), 464; Cook *v.* State, 24 N. J., 843. See also Com. *v.* Lynes, 142 Mass., 577, in a case of alleged incest.)

(4) As to whether an abortion has been performed or attempted. (State *v.* Smith, 32 Me., 370; State *v.* Wood, 53 N. H., 484; Regina *v.* Still, 30 U. C. (C. B.), 30; Com. *v.* Browne, 14 Gray (Mass.), 419.)

(5) As to the nature of a disease with which a person is or has been afflicted: its continuance; its severity and probable duration; the probability of its recurrence; its effect upon the general health; its cause; the remedy; its characteristics, whether hereditary; and as to the probable state of health of the person examined. (Napier *v.* Ferguson, 2 P. & B. (N. B.), 415; Jones *v.* White, 11 Humph. (Tenn.), 268; Flynt *v.* Bodenhamer, 80 N. Car., 205; Polk *v.* State, 36 Ark., 117; Hook *v.* Stovel, 26 Ga., 704; Cock *v.* Potter, 68 Pa. St., 342; Linton *v.* Hurley, 14 Gray (Mass.), 191; Cooper *v.* State, 23 Tex., 336; Litch *v.* McDaniel, 13 Ired. (N. Car.), 485; Edington *v.* Ætna Life Ins. Co., 77 N. Y., 564; Eckles *v.* Bates, 26 Ala., 655; Wiley *v.* Portsmouth, 35 N. H., 303); Filer *v.* N. Y. Central R. Co., 49 N. Y., 42; Pidcock *v.* Porter, 68 Pa. St., 344; Anthony *v.* Smith, 4 Bosw. (N. Y.), 503; Matteson *v.* N. Y., etc., R. Co., 62 Barb. (N. Y.), 364; Cooper *v.* State, 23 Texas, 336; Jones *v.* Tucker, 41 N. H., 546; Welch *v.* Brooke, 10 Rich. (S. C.), 124; Lake *v.* People, 1 Parker's Crim. Cases, 495; Pitts *v.* State, 43 Miss., 472; U. S. *v.* McGlue, 1 Curtis (U. S.), 1; Napier *v.* Ferguson, 2 P. & B. (N. B.), 415; Washington *v.* Cole, 66 Ala., 212; Janes *v.* White, 11 Humph. (Tenn.), 268; Moore *v.* State, 17 Ohio, 521; Morrissey *v.* Ingham, 111 Mass. 63; Sanderson *v.* Nashua, 44 N. H., 492.)

f. Experts in the use of the microscope, the micrometer, or familiar with the scientific chemical tests, may give opinions as to whether blood is human, or that of animals, birds, or amphibia. (Knoll *v.* State, 55 Wis., 249; s. c. 42 A. M. Rep., 704; Com. *v.* Sturtivant, 117 Mass., 122; State *v.* Knight, 43 Me., 1.)

g. The confusion into which expert testimony in this respect has fallen in American courts is worthy of notice.

(1) Certain experts affirm that they can discriminate between human blood and that of all the domestic animals, save a dog, and from all mammalian blood, except the opossum, the guinea pig, the rabbit, the wolf, seal, beaver, monkey,

and a few others, by the diameters of the red blood corpuscles, under a microscope of very high powers. Others deny this, and assert that, while all mammalian blood can be distinguished from that of birds, fishes, and the amphibia by the shape of the red corpuscles and their structure, the extent to which the expert can go is to state that the blood is mammalian and is consistent with and similar to human or other mammalian blood. (R. U. Piper, in 15 Amer. Law Register, 561; 16 Amer. Law Register, 257; 19 Amer. Law Register, 529 and 593; 10 Central Law Journal, 183; 26 Amer. Law Register, 20; Thomas *v.* State, 67 Ga., 460; Reese, Text-Book Med. Jur., 2d Ed., 133; Wormley on Microchemistry of Poisons, 735–6; 1 Tidy Legal Medicine, Phila. Ed., 231; Prof. Richardson, in London Lancet, II, p. 210, 1875; I, pp. 321 and 700; Prof. M. D. Ewell, of Chicago, Micrometric Study of the Red Blood Corpuscles, Amer. Practitioner, of Chicago, 1890, pp. 79 and 173; Prof. H. F. Formad, of Phila., Studies of Mammalian Blood, Journal of Compar. Med. and Surgery, July, 1888; Clark Bell, Blood and Blood Stains, Med. Legal Journal, Vol. 10, No. 2.)

(2) A non-expert may testify that certain stains resembled blood. That is a fact that does not require skilled witnesses to see and recognize. (Thomas *v.* State, 67 Ga., 460; McLain *v.* Com., 99 Pa. St., 86; Dillard *v.* State, 58 Miss., 368; People *v.* Greenfield, 30 N. Y. Sup. Ct., 462; s. c. 85 N. Y., 75; People *v.* Gonzalez, 35 N. Y., 49; Rickerson *v.* State, vol. 1, s. e., Rep. (Ga.), 178.)

h. Competent experts, after a chemical analysis, may give an opinion as to the presence of poison in the internal organs of the body.

(1) If a chemist or toxicologist, the witness need not be a physician or surgeon.

(2) A physician, if shown to be competent, may also so testify, and as to the symptoms of any particular person, and as to whether death resulted from the effects of any poison. (State *v.* Bowman, 78 N. Car., 500; 1 Crim. Law Mag., 294; State *v.* Cook, 17 Kan., 394; State *v.* Terrell, 12 Rich. (S. Car.), 321; People *v.* Robinson, 2 Park Crim. Cases (N. Y.), 236; Polk *v.* State, 36 Ark., 117; Mitchell *v.* State, 58 Ala., 448; State *v.* Slagle, 83 N. Car., 630; Joe *v.* State, 6 Fla., 591; State *v.* Hinkle, 6 Iowa, 380.)

i. A chemist may give his opinions concerning scientific facts or knowledge, upon scientific or technical facts, which his superior and scientific learning enables him to understand and elucidate, and which are beyond the reach of persons not skilled or informed in chemical science. Examples:

(1) Concerning the probability of the evaporation of spirits in certain casks. (Turner *v.* The Black Warrior, 1 McAllister (U. S.), 181.)

(2) Concerning the constituent parts of a mixture. (Allen *v.* Hunter, 6 McLean (U. S.), 303.)

(3) Concerning the safety of lamps. (Bierce *v.* Stocking, 11 Gray (Mass.), 174.)

(4) Concerning the nature of inks. (18 Am. Law Reg., 273; Goodyear *v.* Vosburgh, 63 Barb. (N. Y.), 154; Clark *v.* Bruce, 12 Hun (N. Y.), 271; Sheldon *v.* Warner, 45 Mich., 638; Ellingwood *v.* Bragg, 52 N. H., 448; People *v.* Brotherton, 47 Cal., 388.)

(5) Concerning noxious gases and their effect upon ground contiguous to a copper mill and the result of experiments therewith. (Lincoln *v.* Taunton Mfg. Co., 9 Allen (Mass.), 182; Salvin *v.* North Brancepeth Coal Co., L. R. Ch. App., 705.)

(6) Concerning the analysis of dirt drained by a filter basin, as to the practical utility of the drainage. (Williams *v.* Taunton, 125 Mass., 34.)

j. A competent farrier may testify as to whether a horse is sound or not, and a veterinary surgeon may give his opinion. (Pierson *v.* Hoag, 47 Barb. (N. Y.), 243; Pinney *v.* Cahill, 48 Mich., 584; Spear *v.* Richardson, 14 N. H., 428.)

(1) One not a farrier, if experienced with horses, is competent to say whether the eyes are good or bad, and give his opinion as to defects in the eyes. (House *v.* Frost, 4 Blackf. (Ind.), 293; Slater *v.* Wilcox, 57 Barb. (N. Y.), 604.)

(2) Anyone familiar with horses is competent to state whether a horse seemed well or sick. (Spear *v.* Richardson, 34 N. H., 428; Willis *v.* Quimby, 11 Fost (N. H.), 489.)

(3) A non-expert can not give an opinion as to the appearance and symptoms of cattle alleged to be starved to death. (Stonan *v.* Waldo, 17 Mo., 489.) Nor as to certain appearances in horses alleged to have been overdriven or exposed. (Moulton *v.* Scruton, 39 Me., 288.) Nor as to whether a certain wound is likely to be fatal. (Harris *v.* Panama R. Co., 3 Bosw. (N. Y.), 7.)

k. Insanity.—(1) The opinions of expert alienists and of medical men who are shown to be competent, from knowledge, study, or experience in such cases, are admissible as to the sanity or insanity of a person at a given time; and this evidence can be based upon their personal knowledge and information, or in answer to hypothetical questions based upon the testimony disclosed. (Conn. Mutual Life Ins. Co. *v.* Lathrop, 111 U. S., 612; Dexter *v.* Hall, 15 Wall. (U. S.), 9; Fairchild *v.* Bascomb, 35 Vt., 398; Tulis *v.* Kidd, 12 Ala., 648; Grant *v.* Thompson, 4 Conn., 203; s. c., 10 Am. Dec., 119; Rawble *v.* Tryson, 7 S. & R. (Pa.), 90; s. c., 10 Am. Dec., 444; State *v.* Feltes, 51 Iowa, 495; Dejarnette *v.* Commonwealth, 75 Va., 867; U. S. *v.* Guiteau, 3 Crim. Law Mag., 347; State *v.* Baber, 74 Mo., 292; People *v.* Hall, 48 Mich., 482; People *v.* Schuyler, 106 N. Y., 298; Quaife *v.* Chicago, etc., R. Co., 48 Wis., 513; in the matter of the Will of Blakely, 48 Wis., 294; Goodwin *v.* State, 96 Ind., 550; Coryell *v.* Stone, 62 Ind., 307; Davis *v.* State, 35 Ind., 496; Buswell on Insanity, section 250; Boardman *v.* Woodman, 47 N. H., 120; Commonwealth *v.* Rogers, 7 Met. (Mass.), 500.)

(2) Non-professional witnesses who are not experts, who have known and been familiar with the person whose mental condition is in question, may state facts, conversations, and circumstances within their personal knowledge, and then give their opinions as to the sanity or insanity of the person. (Cram *v.* Cram, 33 Vt., 15; Charter Oak Life Ins. Co. *v.* Rodel, 95 U. S., 232; Hardy *v.* Merril, 56 N. Y., 227 (overruling the previous decision of the court upon the point); Beaubien *v.* Cicatte, 12 Mich., 459; Grant *v.* Thompson, 4 Conn., 203; Clark *v.* The State, 12 Ohio St., 483; Clary *v.* Clary, 2 Ired. (N. Car.), 78; Baldwin *v.* State, 12 Mo., 223; State *v.* Erb, 74 Mo., 199; Walker *v.* Walker, 14 Ga., 242; Chace *v.* State, 31 Ga., 424; Wood *v.* The State, 58 Miss., 741; Webb *v.* State, 5 Tex. App., 596 (overruling previous decisions in Texas); Garrison *v.* Blanton, 48 Tex., 299; Norris *v.* State, 16 Ala., 776; Leach *v.* Prebster, 39 Ind., 492; Schlencker *v.* State, 9 Neb., 241; Kilgrove *v.* Cross, 1 McCrary C. C., 144; Pinney's Will, 27 Minn., 280; Conn. Mut. Life Ins. Co. *v.* Lathrop, 111 U. S., 612; O'Brien *v.* People, 36 N. Y., 276; s. c., 48 Barb. (N. Y.), 274; s. c., 22 Amer. Rep., 441 (overruling); State *v.* Pike, 49 N. H., 399; s. c., 6 Am. Rep., 533; Pidcock *v.* Potter, 68 Pa. St., 342 s. c., 40 Am. Dec., 481; Sutherland *v.* Hankins, 56 Ind., 343; Eggers *v.* Eggers, 57 Ind. 461; State *v.* Newlin, 69 Ind., 108; Doe *v.* Reagan, 5 Blackf. (Ind.), 217; s. c. Am. Dec., 466; State *v.* Hayden, 51 Vt., 296; Uptone *v.* People, 109 Ill., 169; Polin *v.* State, 14 Neb., 540; People *v.* Wreden, 59 Cal., 392; Coles *v.* State, 75 Ind., 511; Dejarnette *v.* Commonwealth, 75 Va., 867; Dunham's Appeal, 27 Conn., 193; Hathaway *v.* Ins. Co., 48 Vt., 335; Morse *v.* Crawford, 17 Vt., 499; Potts *v.* House, 6 Ga., 324; Vanauken's Case, 2 Stock. Ch. (N. J.), 190; Brooke *v.* Townshend, 7 Gill (Md.), 10; Dewitt *v.* Barley, 17 N. Y., 342; Hewlett *v.* Wood, 55 N. Y., 634; Clapp *v.* Fullerton, 34 N. Y., 190; Rutherford *v.* Morris, 77 Ill., 397; Duffield *v.* Morris, 2 Harr. (Del.), 375; Wilkinson *v.* Pearson, 23 Pa. St., 119; Dove *v.* State, 3 Heisk. (Tenn.), 348; Butler *v.* Ins. Co., 45 Iowa, 93; People *v.* Sanford, 43 Cal., 29; State *v.* Klinger, 46 Mo., 229; Holcombe *v.* State, 41 Tex., 125; McClaskley *v.* State, 5 Tex. App., 320; Norton *v.* Moore, 3 Head (Tenn.), 482; Powell *v.* State, 25 Ala., 28.)

V.

(6) *Exceptions to both rules.*—(1) The subscribing witnesses to a will may always give their opinions as to the sanity or insanity of the testator at the time he signed the will in their presence, whether they are experts or not, and without reference to who they are. The reason of this lies in the fact that the law provides that the proof of the will must rest upon their evidence, and in the nature of things their evidence is competent upon all questions necessary to be established to prove the will. And this does not depend upon whether they state the facts or circumstances upon which their opinion is based or not. (Williams *v.* Lee, 47 Md., 321; Van Huss *v.* Rainbolt, 42 Tenn., 139; Hardy *v.* Merrill, 56 N. H., 227; Poole *v.* Richardson, 3 Mass., 330; Potts *v.* House, 6 Ga., 324; Dewitt *v.* Barley, 9 N. Y., 371; Grant *v.* Thompson, 4 Conn., 203; Wogan *v.* Small, 11 S. & R. (Pa.), 141; Robinson *v.* Adams, 62 Me., 369; Williams *v.* Lee, 47 Md., 321; Buswell on Insanity, secs. 240, 265-266.)

(2) In some States the opinions of nonexpert witnesses as to the sanity or insanity of a person is not received, and have been excluded upon the ground that they are not proper exceptions to the general rule, which excludes the opinions of witnesses upon subjects concerning which they have no special or scientific knowledge.

Notably in Massachusetts, where the courts still adhere to this doctrine. (Hastings *v.* Rider, 99 Mass., 622; Townsend *v.* Pepperell, 99 Mass., 40; Phelps *v.* Hartwell, 1 Mass., 71; Poole *v.* Richardson, 3 Mass., 330; Needham *v.* Ide, 5 Pick. (Mass.), 510; Commonwealth *v.* Wilson, 1 Gray, 337; Commonwealth *v.* Fairbanks, 2 Allen (Mass.), 511; Buswell on Insanity, sec. 248; Amer. and Eng. Encyclo. of Law, vol. 7, p. 504; Cowles *v.* Merchants, 140 Mass., 377; May *v.* Bradley, 127 Mass., 414; Commonwealth *v.* Brayman, 136 Mass., 438; Baxter *v.* Abbott, 7 Gray (Mass.), 71.)

Also in Maine. (Wyman *v.* Gould, 47 Maine, 159; Heald *v.* Thing, 45 Me., 392; Inhabitants of Fayette *v.* Inhabitants of Chesterville, 77 Me., 28; s. c. 52 Am. Rep., 741.)

Also in Texas. (Gehrke *v.* State, 13 Texas, 508; Hickman *v.* State, 38 Texas, 191.)

And in Iowa and Mississippi. (State *v.* Geddis, 42 Iowa, 268; Reed *v.* State, 62 Miss., 405.)

In New York the early decisions were adverse to the admission of nonexpert evidence. (Sears *v.* Shafer, 1 Barb., 408; Dewitt *v.* Barley, 9 N. Y., 371; Same *v.* Same, 17 N. Y., 340; People *v.* Lake, 12 N. Y., 358; Gardiner *v.* Gardiner, 34 N. Y., 155; Deshon *v.* Merchants' Bk., 8 Bosw. (N. Y.), 461; Clapp *v.* Fullerton, 34 N. Y., 190, 461; approved in O'Brien *v.* People, 36 N. Y., 276.)

But the doctrine has since been settled in that State that nonexperts may testify as stated in above subdivision *a*, in accordance with what may be regarded as now the well-settled general rule. (Hewlett *v.* Wood, 55 N. Y., 634; Howell *v.* Taylor, 11 Hun (N. Y.), 214; Arnold's Will, 14 Hun (N. Y.), 525; Sisson *v.* Conger, 1 T. & C. (N. Y.), 564; Goodell *v.* Harrington, 3 T. & C. (N. Y.), 315; Real *v.* People, 55 Barb. (N. Y.), 576; s. c. 42 N. Y., 270.)

(3) Courts have held that a Roman Catholic priest, who is required by his priestly office to pass upon the sanity or mental state of those who receive the sacraments at his hands, is a qualified expert, and as such may answer a hypothetical question as to the sanity of any individual. (Estate of Toomes, 54 Cal., 509; s. c. 35 Am. Rep., 83; Amer. and Eng. Enc. of Law, Vol. 7, p. 504.)

VI.

(7) *Who is a competent expert in cases of insanity.*—To entitle a person to give an opinion as an expert the witness must be a person who is conversant with insanity, who has made the subject of mental diseases a special study, and, as stated in the rule defining what an expert is, he must be shown to have a particular and special scientific and technical knowledge upon the subject of insanity.

(Reese, Med. Juris. and Tox., 1891, p. 19; Hastings *v.* Rider, 99 Mass., 622; Buswell on Insanity, sec. 248, and cases there cited; Commonwealth *v.* Rogers, 7 Met. (Mass.), 500; s. c. 4 Am. Dec., 458; Commonwealth *v.* Rich, 14 Gray (Mass.), 355; Clark *v.* Bruce, 12 Hun (N. Y.), 271; Kennedy *v.* People, 39 N. Y., 245.)

a. An exception is made in case of the family physician, who is assumed to have superior knowledge and means of information more than ordinary persons, and who may give an opinion. (Hastings *v.* Rider, 99 Mass., 625; Dickinson *v.* Barber, 9 Mass., 225; s. c. 6 Am. Dec., 58; Hathorne *v.* King, 8 Mass., 371; s. c. 5 Am. Dec., 106.)

VII.

(8) As all persons can testify from their knowledge, based upon facts under their own observation, as shown in subdivision *a*, *infra*, this embraces not only all physicians, but all experts, and leaves the question of opinion evidence by skilled experts narrowed to the true rule of opinion, testimony by skilled witnesses, and should be confined to hypothetical questions, a fact frequently lost sight of by courts and counsel.

a. Opinions of experts which usurp the functions or province of the jury are inadmissible, and should have little weight with courts or juries. For example, the question of insanity is a question of fact to be shown by evidence. The question of whether the accused is responsible is a question of law. The opinions of a medical expert, who by his opinion passes on the question of responsibility, usurps the functions of the jury, and such testimony lacks all the elements of evidence, and should have no weight. (Buswell on Insanity, secs. 253 and 254; Princep *v.* Dyce Sombre, 10 Mo. P. C., 232; Stackhouse *v.* Horton, 2 McCart, 202; Watson *v.* Anderson, 13 Ala., 202; McAllister *v.* State, 17 Ala., 434; Slais *v.* Slais, 9 Mo. App., 96; Francke *v.* His Wife, 29 L. Arm., 302; Parnell *v.* Commonwealth, 86 Penn. St., 260; Regina *v.* Richards, 1 F. & F., 87; Fairchild *v.* Bascombe, 35 Vt., 398; The Province of Medical Expertism, by Judge Charles G. Garrison, Med. Legal Journal, 1890, p. 486.)

b. It has been held "that the opinions of medical experts upon the subject of insanity are to be received with peculiar caution, for the reason that while an expert in the exact sciences, or in mechanics, has tangible or ascertainable facts on which to base his opinions, those scientists who profess to understand the quality or emotions of the human mind have in great part to rely upon mere conjectures for their inductions, which are often warped or fitted to pet theories or prejudices. The trend of judicial thought in America and England is that the mere opinions of medical experts are of little or no value in enlightening courts or juries as to the facts of the cases which are to be determined. (People *v.* Lake, 12 N. Y., 358; Buswell on Insanity, sec. 253; Doughty *v.* Doughty, 3 Halst. Ch., 643; People *v.* Finley, 38 Mich., 482; Regina *v.* Southey, 4 F. & F., 864.)

And in New York it has been held that where an expert witness has heard all the testimony and based his opinions upon it, he is not competent to give an opinion upon the general question of sanity or insanity, because his answer practically usurped the province of the jury, and that he should only be allowed to give an opinion as to what the facts proved or claimed to be proved indicated as to the mental condition of the party. (People *v.* Lake, 12 N. Y., 358; People *v.* Thurston, 2 Parker Cr. (N. Y.), 49; Sanchez *v.* The People, 22 N. Y., 147; Arnold's Will, 14 Hun (N. Y.), 525; Hagadorn *v.* Conn. Mut. Life Ins. Co., 22 Hun (N. Y.), 249.)

VIII.

(9) The dicta of the court in Conn. Mut. Life Ins. Co. *v.* Lathrop, 111 U. S., 612, in explaining the reason of the now almost universal rule allowing anyone, and especially nonexperts, to give an opinion based upon facts within their own personal knowledge, correctly states the law and the reasons of its general adoption.

Whether an individual is insane or not is not always best solved by abstruse metaphysical speculations expressed in the technical language of medical science. The common sense, and we may add the natural instincts, of mankind reject the supposition that only experts can approximate certainty upon such a subject. The truth is that the statement of a nonprofessional witness as to the sanity or insanity at a particular time of an individual whose appearance, manner, habits, and conduct come under his personal observation is not the expression of a mere opinion. In form it is opinion, because it expresses an inference or conclusion based upon observation of the appearance, manner, and motions of another person, of which a correct idea can not well be communicated in words to others, without embodying more or less the impressions or judgment of the witness. But in a substantial sense, and for every purpose essential to a safe conclusion, the mental condition of an individual as sane or insane is a fact. Not, indeed, a fact established by direct and positive proof, because in most, if not all, cases, it is impossible to determine, with absolute certainty, the precise mental condition of another. Yet, being founded on actual observation, and being consistent with common experience and the ordinary manifestations of the condition of the mind, it is knowledge so far as the human intellect can acquire knowledge upon such subjects.

a. As to the disposition, characteristics, or idiosyncrasies of a person any witness who knows is competent to testify and need not be an expert.

(1) As to whether he was fickle minded. (Mills *v.* Winter, 94 Ind., 329.)

(2) Whether he was intoxicated. (City of Aurora *v.* Hillman, 90 Ill., 66; State *v.* Huxford, 47 Iowa, 16; Stacy *v.* Portland Put. Co., 68 Me., 279; Pierce *v.* State, 53 Ga., 365; State *v.* Pike, 49 N. H., 407.)

(3) Whether he was angry at a certain time. (State *v.* Shelton, 64 Iowa, 333.)

(4) Peculiar affection for a third person, if known to the witness or observed by him. (McKee *v.* Nelson, 4 Cow. (N. Y.), 355; s. c. 15 Am. Dec., 384.)

b. Masters of vessels or experienced seamen may give their opinions on questions pertaining to nautical science or affairs. (Delaware & Co. *v.* Starrs, 69 Pa. St., 36; Baird *v.* Daily, 63 N. Y., 547; Western Ins. Co. *v.* Tobin, 32 Ohio, 77; Perkins *v.* Augusta Ins. Co., 10 Gray (Mass.), 312; Parsons *v.* Mig., etc., Ore Co., 16 Gray (Mass.), 463; Zugasti *v.* Lainer, 12 Moore P. C., 331; Reed *v.* Dick & Watts, (Pa.), 479; Jameson *v.* Drinkald, 12 Moore, 148; Fenwick *v.* Bell, 1 C. & K., 312; Carpenter *v.* Eastern Trans. Co., 71 N. Y., 574; Dolz *v.* Morris, 17 N. Y. Sup. Ct., 202; Steamboat Clipper Co. *v.* Logan, 18 Ohio, 375; N. E. Glass Co. *v.* Lovel, 7 Cushing (Mass.), 319; Eastern Trans. *v.* Hope, 95 U. S. 297; Walsh *v.* Walsh, etc., Ins. Co., 32 N. Y., 427; Guiterman *v.* Liverpool, etc., Ins. Co., 83 N. Y., 358; Ogden *v.* Parsons, 23 Howard (N. S.), 167; Lapham *v.* Atlas Ins. Co., 24 Pick. (Mass.), 1; Paddock *v.* Con. Ins. Co., 104 Mass., 521; Moore *v.* Westervelt, 7 Bosw. (N. Y.), 558; Price *v.* Powell, 3 N. Y., 322; Leitch *v.* Al. Mut. Ins. Co., 66 N. Y., 100.)

c. Opinions may be given by persons skilled therein concerning the running and management of railway trains, and as to questions concerning railway construction, repairs, or management. [Bellefontaine, etc., R. Co. *v.* Bailey, 11 Ohio, 333; Seaver *v.* Boston, etc., R. Co., 14 Gray (Mass.), 466; Cinn., etc., R. Co. *v.* Smith, 22 Ohio, 227; Mobile, etc., R. Co. *v.* Blakely, 59 Ala., 471; Jeffersonville R. Co. *v.* Lanham, 27 Ind., 171; Hilton *v.* Mason, 92 Ind., 157; Fitts *v.* Creon City R. Co., 59 Wis., 323; Baldwin *v.* Chic., etc., R. Co., 18 Am. Law Reg., 761, and note; s. c. 50 Iowa, 680.)

d. Generally an artisan, mechanic, or person skilled in any pursuit, avocation, or calling, may be examined as to matters relating to his avocation, concerning which he is shown to have peculiar and especial knowledge. (Sheldon *v.* Booth, 50 Iowa, 209; Scattergood *v.* Wood, 79 N. Y., 263; Burns *v.* Welch, 8 Yerg., (Tenn.), 117; Inpitz *v.* People, 34 Ill., 516; Union Pacific R. Co. *v.* Clopper, 102 (U. S.), 708; Woodruff *v.* Imperial Fire Ins. Co., 83 N. Y., 133; Ward *v.* Kilpatrick, 85 N. Y., 413; Campbell *v.* Russell, 139 (Mass.), 278; Terre Haute *v.* Hudnut, 18 Am. and Eng. Corp. Cas., 302; Folkes *v.* Chadd, 3 Doug. (Mich.), 157; Barnes *v.* Ingals, 39 Ala., 193; Davis *v.* Mason, 4 Peck (Mass.), 156; Knox *v.* Clark, 123 Mass., 216; Brantly *v.* Swift, 24 Ala., 390; Phelps *v.* Terry, 3 Abb. Dec. (N. Y.), 607.)

e. Competent experts, qualified by study and experience, may testify as to the identity or genuineness of handwriting. (Plunkett *v.* Bowman, 2 McCord (S. Car.), 139; Morrison *v.* Porter, 35 Minn., 425; s. c. 59 Am. Rep., 331; Moore *v.* United States, 91 U. S., 270.)

f. Foreign laws can be proved by an expert shown to be competent, if unwritten. If written, a certified copy is the best evidence. (Talbot *v.* Seeman, 1 Cranch (U. S.), 1; Drake *v.* Glover, 30 Ala., 382; Shed *v.* Augustine, 14 Kansas, 282; Church *v.* Hubbard, 2 Cranch (U. S.), 187; Dougherty *v.* Snyder, 15 S. & R. (Pa.), 84; Walker *v.* Forbes, 31 Ala., 9; Hoes *v.* Van Alstine, 20 Ill., 202; Barrows *v.* Downs, 9 R. I., 446, 453; Roberts's Will, 8 Paige (N. Y.), 446.)

IX.

(10) Opinions of witnesses are never received if all the facts can be otherwise ascertained and made intelligible to the jury, or if the question is one that men in general can understand and comprehend. (Clark *v.* Fisher, 1 Paige (N. Y.), 171; s. c. 19 Amer. Dec., 402; Stowe *v.* Bishop, 58 Vt., 498; Penn Co. *v.* Conlan, 101 Ill., 93; Passmore's Appeal, 27 N. W. Rep., 601; Hallahan *v.* N. Y., etc., R Co., 102 N. Y., 104.)

a. Concerning the ordinary affairs of life the jury can form intelligent opinions, and opinions of experts are inadmissible. (Bemis *v.* Centr. Vt. R. Co., 58 Vt., 636; Milwaukee, etc., R. Co. *v.* Kellogg, 94 U. S., 469; Schneider *v.* Barney, 113 U. S., 645; Durrell *v.* Bederly, 1 Holt, 285; Campbell *v.* Richards, 5 B. & Ad., 846; Carter *v.* Boehm, 3 Burr, 1905; Higgins *v.* Dewey, 107 Mass., 494; Neilson *v.* Chic., etc., R. Co., 59 Wis., 516; s. c. Watson *v.* Milwaukee, etc., R. Co., 57 Wis., 332; Gilbert *v.* Guild, 144 Mass., 361; Knole *v.* State, 55 Wis., 249; s. c. 42 Am. Rep., 704.)

X.

(11) The competency of an expert is a question for the court, and it must be clearly shown before his testimony can be received as an expert. (Stennett *v.* Pa. Ins. Co., 68 Iowa, 674; Russell *v.* Crittenden, 53 Conn., 564; Ft. Wayne *v.* Coombes, 107 Ind., 75; Higbee *v.* Guardian Ins. Co., 53 N. Y., 603; Russell *v.* Crittenden, 53 Conn., 564; Hinds *v.* Harbon, 58 Ind., 121; McEwen *v.* Bigelow, 40 Mich., 215; Dole *v.* Johnson, 50 N. H., 452; Castner *v.* Sliker, 33 N. J. L., 96; Flint *v.* Bodenheimer, 80 N. Car., 205; Perkins *v.* Stickney, 132 Mass., 217; Wright *v.* Williams's Estate, 47 Vt., 222.)

XI.

(12) *Hypothetical questions.*—The rule is that a party is entitled to put his case hypothetically, as he claims it to have been proved, and take the opinion of the witnesses thereon, leaving the jury to determine whether the question put covers the case as proved. (Bishop *v.* Spining, 38 Ind., 143; Guetig *v.* State, 66 Ind., 94; Goodwin *v.* State, 96 Ind., 550; Cowley *v.* People, 83 N. Y., 464; s. c. 38 Am. Rep., 464; Quinn *v.* Higgins, 63 Wis., 664; s. c. 53 Am. Rep., 305; Page *v.* State, 61 Ala., 16; Boardman *v.* Woodman, 47 N. H., 120; Yardley *v.* Cuthbertson, 108 Pa. St., 395; s. c. 56 Amer. Rep., 218; Dexter *v.* Hall, 15 Wall. (U. S.), 9; Commonwealth *v.* Rogers 7 Met. (Mass.), 500; s. c. 41 Amer. Dec., 458; Forsyth *v.* Doolittle, 120 U. S., 73; State *v.* Cross, 68 Iowa, 180; Morrill *v.* Tegarden, 19 Neb., 534; Ray *v.* Ray, 98 N. Car., 566; People *v.* Augsburgh, 97 N. Y., 501.)

a. The court should allow counsel great latitude in framing a question based upon the fact as claimed to be proved, if evidence tending to show the facts as claimed to be proved has been given; but the court should not allow hypothetical questions based on alleged facts which have not been proved, or not within the range of legitimate evidence, or containing inferences or conclusions, or when they ask for conjectures; nor those omitting material facts that are conclusively

shown. (Goodwin *v.* State, 90 Ind., 550, disapproving People *v.* Thurston, 2d Park. Crim. Cases (N. Y.), 49; Strong *v.* Stevens Point, 62 Wis., 255; Haisle *v.* Payson, 107 Ill., 365; Cowley *v.* People, 83 N. Y., 464, and cases there cited; Higbie *v.* Guardian, etc., Co., 53 N. Y., 603; State *v.* Stanley, 34 Minn., 430.)

XII.

(13) It is the peculiar province of the jury to decide what weight, if any, they will give to the opinion of an expert. They are not bound by it, and may exercise their own experience upon the subject as to what weight it is entitled to receive. The court has no power over it, and where judges have instructed juries to give greater weight to the evidence of professional witnesses than to non-expert evidence, the verdicts have been set aside as illegal. (Congress, etc., Co. *v.* Edgar, 90 U. S., 645; Schwenger *v.* Raymond, 105 N. Y., 648; Guetig *v.* State, 64 Ind., 94; State *v.* Bailey, 4La. Ann., 376; Von Valkenburgh *v.* Von Valkenburgh, 90 Ind., 433; Stone *v.* Chicago, etc., R. Co., 33 N. W. Rep. (Mich.), 24; Head *v.* Hargrave, 105 U. S., 45; Atchison, etc., *v.* Thul, 32 Kan., 255; Davis *v.* State, 35 Ind., 496; McGregor *v.* Armill, 2 Iowa, 30; Tolum *v.* Mohr, 21 Ark., 349; Chandler *v.* Barrett, 21 La. Ann., 58; Sanders *v.* State, 94 Ind., 147; People *v.* Montgomery, 13 Abb. Pr. (N. S.), (N. Y.), 207; Cunee *v.* Bessorné, 63 Ind., 524; State *v.* Cole, 63 Iowa, 695; Epps *v.* State, 102 Ind., 539; United States *v.* Molloy, 31 Fed. Rep., 19; Templeton *v.* People, 10 Hun (N. Y.), 357; Eggers *v.* Eggers, 57 Ind., 461; Goodwin *v.* State, 96 Ind., 550; Humphries *v.* Johnson, 20 Ind., 190; Spenaley *v.* Lancashire Ins. Co., 62 Wis., 443.

XIII.

(14) An expert witness can not be compelled to give his opinion as an expert, unless he is compensated. He can not be punished for contempt in refusing to appear or testify as such without he is compensated, but he can be compelled to appear and testify to facts within his knowledge, the same as any other witness, without compensation above the statutory fee to which any witness is entitled. (Buchanan *v.* State, 59 Ind., 1; s. c. 26 Am. Rep., 75; 17 Alb. Law J., 242; Dillis *v.* State, 59 Ind., 15; Webb *v.* Page, 1 E. & K., 23; Parkinson *v.* Atkinson, 31 L. J. (N. S.), C. P., 199; *In re* Roelker Sprague, 276; People *v.* Montgomery, 13 Abb. Pr. (N. S.), 207; United States *v.* Howe, 12 Cent., L. J., 193.)

The courts of Alabama and Texas have held that experts are not entitled to extra compensation. (*Ex parte* Dement, 53 Ala., 389; Sumner *v.* State, 5 Tex. App., 365.)

But the weight of authority is otherwise. This subject has been exhaustively treated by Lawson in his work on Expert and Opinion Evidence, and by Rogers on Expert Evidence. The medico-legal authors all treat it, but in a general way. (Wharton & Stillé, 1882; Dean, 1873; Elwell, 1881, 1887; McClellan, 1872; Ordronaux, 1869, 1878; Medico-Legal Papers, series 1, 2, and 3, N. Y.; Taylor, all English and Phil. editions; Woodman & Tidy, 1876, 1884; Naquet's Legal Chemistry, 1876; Taylor on Poisons, 1875; Field's Medico-Legal Guide, 1882; Reese, Med. Jur. & Tox., 1884, 1889, 1891; Bucknill & Tuke, all editions.)

The law authors on evidence (Wharton, Starkie, Greenleaf, Taylor, Best, Wood) all treat the subject in their works on evidence, to which the student and the expert should refer; *vide* also Prof. Washburn's paper in 1 Am. Law Review, 62.

For reference to authorities and decisions, the American and English Encyclopædia of Law and Abbott's New Digest are the best sources of information.

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ADDRESS OF THE PRESIDENT OF THE SECTION, DR. J. COLLINS WARREN, BOSTON, MASS.

MEDICAL EDUCATION IN THE UNITED STATES.

GENTLEMEN: The work of this section is of a character which does not usually form a prominent part in the proceedings of medical gatherings. In almost every department of education pedagogy, or the science of teaching, is a recognized specialty. The rapid progress which has been made in medical education in this country within the last few years has brought about such profound changes in the methods of instruction and the strides which medical science is making all over the civilized globe are bringing into view so many new fields of work that the teachers of to-day have a far more complex and difficult task than was presented to their predecessors. The art of teaching medicine has never been taught, in this country, at least. The time has arrived to take up the subject. In introducing such a subject as this it seems appropriate to take a brief retrospective glance at the history of medical education in this country. There lies before me as I write a quaint little volume entitled A Discourse upon the Institution of Medical Schools in America, published in 1765. It bears the following inscription: "To Dr. John Warren, physician in Boston, this copy * * * is presented by his respectful and affectionate friend, John Morgan, Philadelphia, February 27, 1783." This book may be safely regarded as the first contribution to the subject which we are to discuss to-day, and the two dates are memorable; the former indicates the foundation of the medical department of the University of Pennsylvania and the latter the birth of the medical department of Harvard University. Dr. Morgan justly remarks that "medicine is a science as important in its object as it is difficult in its acquisition. It is very extensive in its researches and presupposes the knowledge of many other sciences. The cultivation of it requires no small ability and demands of those who engage in the arduous pursuit an enlarged and benevolent mind." It is interesting to note that one whom we might justly look upon as the father of medical education in this country, and who "had spent five years in Europe under the most celebrated masters in every branch of medicine," should have taken so optimistic a view of the knowledge of medicine at that time as to say, "The industry of many centuries has already been employed to bring physic to that degree of perfection at which it is now arrived." Fortunately, he adds: "It will still require a long time to remove the obscurities which yet veil many parts of it." Three years after this book was written Pennsylvania held her first medical commencement and the provost justly remarked, "This may be considered the birthday of medical honors in America." The men who started this movement had received much encouragement from across the ocean, and the remark of one of their teachers, Dr. John Fothergill, of London, is of special interest to those concerned in the work of this congress. Writing to James Pemberton, in 1762, he recommends Drs. Shippen and Morgan as men well qualified for the work of teaching, "both of whom," he says, "will not only be useful to the province in their employment, but if suitably countenanced by the legislature will be able to erect a school of physic amongst you that may draw students from various parts of America and the West Indies." During the colonial period of our history it was the custom for young men who entered upon the study of medicine to become regularly apprenticed to some practitioner for a term of three or four years, during which time the preceptor was entitled to the student's services in preparing and dispensing medicines and services as an assistant in minor surgical operations. As a return for this the physician was obliged to give the student detailed and thorough instruction in all the branches of medicine. Many of the leading men frequently had several students in their offices,

constituting a small class, who were drilled as regularly in their studies as they would be in college. In some instances the term of apprenticeship was extended even to six and seven years.[1]

When the medical school sprang into existence it was at first intended merely to supplement the apprentice system, and as means of communication of one part of the country with another were exceedingly limited, it was found desirable to concentrate school work into as small a part of the year as possible. Hence the origin of the short term of four months which has clung so persistently to the American system. I will not undertake to weary you with a detailed account of the history of the development of our system of education. Suffice it to say that the close of the century found schools established not only in Pennsylvania and Massachusetts, but in New York, Maryland, and Vermont. There were, however, in 1810, only two medical schools in existence, with an aggregate number of medical students of about 650, of whom 100 received the degree either of bachelor or doctor of medicine. The bachelors' degree was given to those who had attended the full course of college instruction. It was hoped that such students, after a short period of practice, would eventually return to take the higher degree, but as this expectation was not fulfilled, the degree of bachelor of medicine was soon wisely abolished. A noticeable feature of the education of that early period in our medical history was the requirement for a high standard of general education. Those students who did not possess a college degree were expected to pass an examination in Latin, mathematics, and natural and experimental philosophy. To obtain the degree of doctor of medicine it was necessary that the applicant should have been a bachelor of medicine for at least three years, should have attained the age of 24 years, and should write and defend a thesis publicly in the college.[2] When we consider how imperfect was the knowledge of chemistry, physiology, and even anatomy, and many other branches of medical science, and how little of what we now consider the foundation of medical education there was to teach, such a course must be regarded as a very complete and exacting one. "Under these influences the first thirty years sufficed to cause the bachelor's degree to be abandoned by all the schools, the number of professors in each school to be doubled, and the length of the annual college term to be shortened one-third." (Davis.) Such was the standard of education with which the present century opened. New schools continued to be created, not infrequently in connection with some university, as in 1810 at Yale University, in 1817 in Lexington, Ky., in 1820 at Brunswick, Me., in 1825 at Charlottesville, Va., until in 1840 twenty-six new medical colleges had been added to the list—the whole number of students in the country amounting to 2,500, the population in that year being 17,069,453. A glance at the report of a committee to the Medical Society of the State of New York in 1833 gives a good idea of the amount of work done by the schools at that period. In the twenty schools mentioned in this report the number of courses of lectures required was two, with one exception, that of the University of Virginia, where three courses were required; and, to the credit of this university be it said, the length of each course was ten months, whereas the almost invariable custom of the other schools was to give a course of four months' duration only. The time of study purported, however, to be in all cases three years, "including the time devoted to lectures," as is stated in most of the reports. This straw indicates that at that time the chief dependence, or nearly so, was placed upon the extra-mural instruction which was given to the student. At Yale University there was this additional requirement, namely, that the student was required to study four years "if he had not graduated," which phrase, I presume, means if he had not already taken the academic degree. This seems to be the first intimation that a longer term than the

[1] N. S. Davis, Med. Ed. and Med. Institutions in the United States of America, 1877.
[2] William Pepper, Higher Medical Education, 1877.

standard then set was necessary for a complete equipment for the practice of medicine.

The Medical Institution of the State of Georgia (incorporated in 1828) gave at first the bachelor's degree with one year of study, but immediately abandoned it for the usual curriculum. In the University of Pennsylvania, to which we look for the standard in these early as well as later days, two full courses were required, but, as in many other schools, one course only was demanded from those who had attended a course at some other reputable school. In addition, a course of clinical instruction in one of the Philadelphia hospitals was required. The course was then for three years, but as the course of lectures was only four months, it was expected that during the remaining portion of the first two years the student should receive private instruction. As the period of the school term was so short, it is interesting to note at what time of the year the various courses of lectures began. This, it will be seen, varied greatly according to the geographical position of the institution. At Dartmouth and the University of Vermont the term began in August; in Bowdoin College, Maine, however, it began in the middle of February, continuing until the middle of May; that is, term time in the far North was in the summer or spring; at Yale and Harvard, and in Philadelphia and New York, the term opened at the end of October or the beginning of November, as did also the schools in South Carolina and Kentucky. The University of Virginia, with its long course of ten months, began September 10. Although the term time was exceedingly short in some schools, a large amount of work was crowded into the daily routine of the students. Five or six systematic lectures a day, with attendance on clinics and dissections when possible, was considered nothing more than a fair amount of work for the medical student to digest properly. This system of teaching continued practically unaltered in 1851, if we may judge from a report to the committee on medical education of the American Medical Association.[1] In regard to the private instruction which was supposed to continue during the remaining eight months of the year, the report states that a very large proportion of students simply read medicine under the direction of their preceptors. Anything like careful instruction upon the part of the teachers did not exist. The student, neither while attending lectures nor while in his preceptor's office, was encouraged in anything like faithful and rigid study. To remedy this defect private schools for teaching medicine were founded by enterprising physicians and surgeons, and these quiz classes which were here inaugurated became a prominent feature of the national system of teaching. Many a distinguished professor has won his spurs in these private schools, and many valuable experiments in medical education carried on by these men. As the college term has lengthened the necessity for these accessory courses has diminished, and in many cities the extra course instruction, whether by private school or teacher, has passed into history. No one will, I presume, regret the departure of the year of private teaching "by some respectable practitioner" whose certificate, purchased by a handsome fee, came eventually to have so little meaning. When this custom was first inaugurated it was the sole method of instruction, and during the long period of apprenticeship the student received a large amount of instruction of the most valuable sort. When the medical school came into existence the attempt was made to combine the two systems. The practitioner, relieved from the responsibility of giving a complete course of study to the student, gradually relaxed his efforts as a teacher until this part of his daily work came to have only a nominal value. According to Davis it consisted in 1877 in little more than the registry of the student's name in the doctor's office, permission to read the books of his library, or not, as he chose, and the giving of a certificate of time of study for the student to take to the medical college where

[1] W. Horker, M. D., 1851.

he expected to graduate. At the beginning of this century the successful practitioner gave a prominent place in his household to the medical student. I have often heard my father, and many other practitioners of his day, tell stories of the school life of those times. The office in the old homestead where I began the practice of medicine, then a luxurious library, was in those times a plain room with a sanded floor, occupied during the day by a small band of medical students who all boarded in the same house. The old room was the scene of many amusing stories of schoolboy life, and also of thrilling tales of escape from the indignant pursuer of the hero of some graveyard scrape, which was rendered necessary by the peculiar laws of that period. This phase of student life has long since passed away, and the equally agreeable and far more profitable experience of hospital life has taken its place. Would that I could add that such experience was now the privilege of every medical student in the land.

As we approach the middle of the century we find the nation growing rapidly in population and prosperity, and a corresponding increase in the numbers and activity of the medical profession. From 1830 to 1845 the number of medical schools in the United States had more than doubled. At a meeting of the Medical Society of the State of New York in 1839, when the subject of medical education was brought forward, it was proposed to hold a national medical convention the following year in Philadelphia, consisting of representatives from the different schools and State societies. No response was made to the action of this society; but in 1844 Dr. N. S. Davis, then a delegate from Broome County, N. Y., offered a resolution that a national convention be called in 1846, and the American Medical Association thus sprang into existence, the fundamental idea which brought about the formation of the association being the improvement of our system of medical education. It was high time that some such movement should take place, as the rapid increase in the number of medical schools brought with it a constant increase in the laxity of methods of teaching. The equipment of a new school was sometimes pathetic in its meagerness, a manikin and a few lecture rooms often constituting the entire "plant" of the infant institution. It would not do to question the dean too curiously about the clinical facilities which the school enjoyed, and as for laboratory work, there were few teachers sufficiently advanced in their ideas to think of criticising the absence of such instruction. There was, indeed, no time for it. Every available space in the tabular view was filled with lecture hours. Professors were asked to come from neighboring towns to assist in teaching, and often gave two lectures in the same day. This cramming process, which seems so thoroughly American in its hustling activity, is perpetuated to the present day in a limited number of schools, chiefly those situated far from medical centers. As Holmes has said, life at that time was cheap—medical visits in the country were only worth 25 cents apiece—and the ambitious student could not afford to make an expensive outlay for his future work. The American Medical Association thereupon justly put on record its opinion "that the abuses which exist in the modes of medical education pursued in this country demand the serious consideration of the profession," and at each meeting it continued to sound a note of warning on this all-important subject. One of the principal reforms which it proposed to bring about was the lengthening of the term of each year from four to six months, and you will doubtless be somewhat surprised to hear that at the second meeting of the association, which was held in Boston, a paper was presented from the faculty of Harvard University opposing this proposition. *Tempora mutantur, et nos mutamur in illis.* If Harvard was unwilling to lead in the matter of reform at that time, it is not surprising that the other schools should not have been persuaded to change their customs. To the Chicago Medical College, which was founded in 1859, must be given the credit of having been the first to attempt to lengthen the college course and to establish

the system of teaching upon the so-called "graded plan."[1] The school was in fact organized for this express purpose. Little change was, however, effected by the association in the methods of teaching at that time, although the discussions which were constantly held were destined eventually to bring forth good fruit. During the following decade little was done in the way of reform.

Graduating from the academic department of Harvard in 1863, I had an opportunity to study personally the methods in vogue at that time, and am the more competent to express an opinion, as I passed one year of my course of study in Philadelphia. The old system of medical education was then in all its glory, and presented a striking contrast to one who had been subjected for four years to the strict discipline of a well-conducted university. The course of lectures in Philadelphia began about the 1st of November. The day was occupied in a bewildering succession of lectures, on all of which the student felt called upon to attend, as he had been obliged to "take out tickets" for the full course. The teachers were able, conscientious, and in many cases brilliant men, and many a lesson there learned has been of value in after life. Clinical teaching was, however, largely crowded aside by the superabundance of systematic lectures. The course came to an end on the 1st of March, and the class, which was an enormous one, was allowed to scatter to the four quarters of the country. Many of my classmates returned the following autumn, and after attendance on a second course of lectures, and having also handed in the certificate of study from the "respectable practitioners," were able to graduate in the following March; that is, after having been connected with the school less than eighteen months. This may appear to the younger members of this section an absurdly short "curriculum," but there were a considerable number of enterprising young men who did not propose to occupy a long time in obtaining their education.

You will remember what has already been said about the period of the year occupied by the school term. At that time there were not only schools who had their college "year" in the winter, but there were spring "years" and summer "years" as well. Several of my friends proposed accordingly, after leaving Philadelphia in March, to take a spring "year" at another school, in accordance with a custom which many at that time followed. Such a student was therefore able, on July 1, to show to the examining body tickets for two full courses of lectures and a letter testifying to private instruction. It was notorious that many students at that time were able to obtain a degree after nine months only of medical study. The custom of short courses of study at different periods of the year unfortunately still prevails. This zodiacal paradox has not yet been fully eliminated from the medical calendar. The condition of teaching at Harvard was practically the same as at Philadelphia. It is not surprising that the best class of students were dissatisfied with the opportunities and that the number of them who found it necessary to go to Europe to complete their education was constantly increasing. Two and even three years of study was not considered too long a time to occupy in this manner. It is true that spring terms of a supplementary nature were organized by most schools and those students who chose to remain could receive instruction throughout the year. The majority of students, however, disappeared, many of them employing their time in other occupations to earn sufficient money to pay for a second course of lectures. The class of individuals who studied medicine at that time seemed far inferior to the medical students of to-day in culture and refinement. President Eliot says of the students of that period: "In this university until the re-formation of the school in 1870–'71 the medical students were noticeably inferior in bearing, manners, and discipline to the students of the other departments; they are now (1888) indistinguishable from other students." The date which I have just mentioned marks the era of a great change in the history

[1] N. S. Davis's Contributions to the History of Med. Ed., etc., 1877.

of medical education. The rising generation of teachers were not content with the antiquated methods of a previous century; they had learned of a new order of things in the centers of medical learning in Europe, and as the old generation of teachers went out and a new one came in the modern ways of teaching grew into a substantial system which had come to stay. Harvard adopted the graded course of three years' study, but she also did far more than that—and in this respect she stands in advance of almost every other school in the country. She lengthened her course to nine months, so that her two terms correspond with those of the other departments of the university and represent a full year's work. I will not undertake to record the history of the reform in medical education since that time; it is familiar to most of you. The example which has been set to the rest of the country by the University of Pennsylvania and by the College of Physicians and Surgeons of New York are too well known for me to repeat them here.

While criticising, as I have done, the work of a previous generation, I ought to remind you that our forefathers accomplished what they did only by individual efforts. There were no Government endowments, and, as a rule, no liberal benefactors to back them in their undertakings. Their schools had to be conducted on business principles, with a keen eye to the financial success of their venture. During the past twenty years, it is true, a number of State universities have been established. In the University of Michigan, and possibly in one or two other State universities, the medical professorships, like those of other departments, are sustained by the income from the general endowment, independent of fees derived from medical students, but, as a rule, the success of the school has depended upon the patronage which it has received. It may be justly said, therefore, that the whole system of medical education in this country is the spontaneous outgrowth of the work of the medical profession, and that it is due to their public spirit and disinterestedness that so important a department in the educational development of a great nation has been brought to its present state of excellence. The good work has, however, but just begun. The reform of medical education is still in its infancy. If we are to believe all the glowing announcements which we read in the annual catalogues of the various schools, we might be lulled into a sense of calm security for the future, but, unfortunately, the actual practice of many, I might say a majority, of the schools does not come up to the ideals which are here set forth.

The essential points in the new scheme of education have been well stated by our president, Dr. Pepper.[1] (1) The establishment of a preparatory examination. (2) The lengthening of the period of study to at least three full years. (3) The careful grading of courses. (4) The introduction of ample clinical and laboratory instruction. (5) The establishment of fixed salaries for the teachers.

In a general way we may obtain some notion of the improvement which has been made by a study of the report of the Illinois State Board of Health for 1891. According to this report there are now 148 medical schools of all kinds in the United States and Canada. The number of these requiring certain educational qualifications for matriculation is 129. The number of schools requiring attendance on three or more courses of lectures was, in 1882, 22; in 1891 the number was 85. There has been also a gradual increase in the duration of the lecture terms from an average of 23.5 weeks in 1882–'83 to 26.3 weeks in 1890–'91. In 1882–'83 there were 8 colleges that had but sixteen weeks. The number of colleges having terms of six months or more is now 111. The number of colleges which have graduated students at the end of the second course of lectures the present year is less than 10 per cent of the whole number of schools in the country. There are now in the United States 32 examining and licensing bodies that do not give

[1] Introductory address, Philadelphia, 1877

instruction. Although the work of these licensing boards is far from uniform, a great deal has been accomplished by them. There are at the present time fifteen States with practice acts that require an examination of all persons desiring to practice medicine in the respective Commonwealths. These States include nearly 50 per cent. of the entire population. In many States the whole complexion of the medical practice has been changed by the clarifying influences of these bodies. The reports on medical education by the Illinois board, I do not hesitate to say, have exerted a more powerful influence on the movement in education than any other publication which our medical literature has produced. The effects of these medical-practice acts, which establish a minumum of time spent at medical lectures and provide an examination for those who wish to become practitioners, are shown in the statistics which have just been given. At the present time State examinations are required in Minnesota, North Dakota, Montana, Washington, North Carolina, Alabama, Florida, Virginia, New Jersey, New York, Nebraska, Maryland, and Utah. Millard,[1] who has had experience in framing the act of Minnesota, believing that it would be an improvement upon the medical-practice acts at present in existence to separate the two functions of the board, the licensing power and the educational supervision, thinks that the best interests of the public will be subserved by assigning the duties of the State licensing power to the various State boards of health. The regulation of all forms of education should, on the other hand, be vested in a central power consisting of a single board, to be known as a State bureau of education, with power to regulate all educational institutions granting degrees, together with the power of granting charters and revoking the same. Particularly should this apply to all institutions wishing to afford the community any of the various forms of higher or special education.

Having thus sketched the progress of medical education up to the present time, let us now glance at some of the points of the present system in which it is desirable that further improvement should be made. The importance of a preliminary training for the study of medicine is a problem which has occupied the attention of our most prominent teachers. That the medical student should have received a fair amount of education goes without saying. The importance of a proper preliminary education is thus forcibly stated by that most experienced of German medical teachers, Prof. Billroth. He says in reply to the objection to a preliminary study of the natural sciences as a basis of a medical education:

> The educated of all nations should not fail to encourage to their utmost knowledge and study in all countries and stations of life. They should not fail to maintain and increase gradually the standard which they have set up both for themselves and others. They should not fail to support the Government in all efforts directed toward this end. The physician, the lawyer, the school-teacher, and the clergyman form the true nucleus of culture in the community. They are, especially in the country and small towns, the representatives of the educated elements of society. The people seek their advice in time of need, and they are their sole source of knowledge in many things. To neglect the education of such persons, to lower their mental and scientific standard, to bring them up so that they have no better education than the tradesman, the tailor, and the cobbler, would be, in my opinion, the suppression of the educational development of a nation, and is a policy both corrupting and immoral in principle, as it would inevitably ruin a nation and bring it prematurely to that point of decadence when it would become the prey of others.

The importance of these views is fully appreciated in Germany, where the professional schools are integral parts of the university, and entrance to the professional schools depends upon the previous completion of the course in philosophy, a course which corresponds to that of our academic degree. In Dr. Holmes's suggestive article on this subject[2] it is shown that while the increase in the total num-

[1] Millard. The Necessity and Best Methods of Regulating the Practice of Medicine. Journal Amer. Med. Assoc., July 30, 1892.

[2] The forthcoming report of the Bureau of Education on professional education in the United States, Journal American Medical Association, January 14, 1893.

ber of medical students has been very great during the last decade, the increase in the number of college men who have entered the profession has been very slight, and in some of the more prominent schools the percentage has even slightly diminished. He says:

It can not, then, be doubted that relatively a smaller number of medical students have a bachelor's degree than in 1880, though the education of the average medical student is superior to the average medical student ten years ago.

Although the proportion of medical students to students of law and divinity is greater in the United States, the relative proportion has diminished in the last ten years, whereas in Germany in the same period; a period during which medicine has become more of a science and the domain of surgery has increased under antiseptic methods, the proportion of medical students to the students of other professions has greatly increased. The reason for this variation in the proportion of medical students in the two countries is explained by the imperfection of our system of education. Educators have not had proper control, and medicine has not been placed upon that dignified scientific basis which it enjoys in Germany. Dr. Holmes complains that the medical department is neglected by every university in the United States. "It is farmed out or left to shift for itself."

Harvard has recently made an attempt to overcome this difficulty by a modification of the academic course, as Welch points out in an article on this subject.[1] If a young man choose the medical profession he should devote at least four years to medical studies, including the preliminary sciences. If he supplements this with a year in a hospital and a year or two in study abroad, and all this work has been preceded by a college academic course, he would not be able to enter upon the practice of his profession much before the age of 30. Dr. H. P. Bowditch,[2] dean of the medical faculty of Harvard, has strongly advocated a change which would overcome this difficulty. The average age of students who enter the Harvard academic department, as President Eliot has shown, has been gradually rising during the whole of this century until it has reached nearly 19 years. The student who enters the medical school therefore finds himself just beginning the preparation of the real work of his life at an age when many of his contemporaries are already engaged in the productive work of their professions. In Germany the best class of students begin their professional studies at a little earlier age than that at which our young men enter Harvard College. As the course of study leading to the degree of doctor of medicine lasts five years, it follows that the German physician is ready to begin practice before he is 23½ years old. The average age of matriculants at Oxford is 19 years, and it is perfectly possible for an Oxford student desiring to study medicine to begin his purely professional studies before the end of his second year of college life. The dean writes me upon this subject as follows:

There are many students in our school who have had one or two years of college life, either as special or regular students, and then have entered the medical school because they have felt the necessity of getting started on their life work. These men would have been glad to take the bachelor of arts degree if it could have been procured in a shorter time, but they consider it too dearly purchased when it involves so much delay in beginning their professional life.

It seemed, therefore, reasonable to the medical faculty of Harvard to make the following proposition, namely: That the academic council should consider the expediency of granting the degree of bachelor of arts to all undergraduates who should subsequently take the longest course of study offered at the professional schools after three years' attendance in the academic department, the professional degree and that of bachelor of arts to be given simultaneously at the end of the

[1] Some of the Advantages of the Union of Medical School and University, 1888.
[2] Remarks Made at a Meeting of the Academic Council, 1887.

professional course. One of the medical studies at least can be obtained in the usual college curriculum, and general chemistry is frequently "anticipated" by students who enter the medical school. It is hoped, indeed, that this course will soon become one of the "preliminary studies" to medicine. It would be a short step to place one or two more of the scientific medical studies on the list of academic elections, and a whole year could thus be anticipated. The relations of professional schools to the university are not appreciated in the same light that they are in Germany, and the proposition of the medical faculty, after much discussion, was finally declined. The advantages of a more intimate relation between the medical school and the university are clearly set forth by Welch in the article referred to. The duplication of laboratories is thus avoided, and men in different branches of science are brought more intimately together. The important departments of botany, zoölogy, and comparative anatomy can not fail to have an elevating influence upon the work done in a medical school. How much more rapidly might not original investigation progress when different branches of science work in a common cause. It is here that the great strength of German science and progress takes its origin. A movement in the same direction is the establishment in our colleges and scientific schools of courses of tuition intended specially for the benefit of those who intend ultimately to study medicine. Such a course has been planned by Prof. Shaler in the Scientific School of Harvard, and a similar course is offered by the Institute of Technology. Prof. Shaler's course preparatory to medicine consists of two years. In the first year we find physics, zoölogy, botany, general chemistry, rhetoric and elementary French or German, and free-hand drawing among the studies required. In the second year there is botany, zoölogy, comparative anatomy, geology, comparative osteology, physics, qualitative analysis, and themes. It is certainly to be hoped that the medical teachers of the United States will not remain content with the very elementary examinations which are now demanded from those students who have not received a college education. The advantage of a previous college training is shown in some statistics given by Billings[1] of examinations conducted by the examining boards of the Army and Navy. Of those candidates who had a college degree 34 per cent were successful, and of those who had no such degree 28.9 per cent succeeded. It is interesting in this connection to note that, taking the medical schools of Harvard, Yale, the College of Physicians and Surgeons, and Bellevue Hospital, of New York, the University of Pennsylvania, and the University of Virginia together, 46.1 per cent succeeded, while for all the rest of the schools in a body 22.3 per cent succeeded.

One of the most prominent features of the new education is the character and amount of laboratory work which is now required by our medical schools. The new building of the Harvard Medical School, erected twelve years ago, showed the importance which its faculty attached to this means of teaching the student. Already the large addition of the Sears Laboratory has more than doubled the facilities of this department of the school. The University of Pennsylvania has felt the necessity of increasing the facilities for laboratory work, and has received a munificent endowment for its department of hygiene. The literature of this part of our educational system is already becoming voluminous. The recent reports of Vaughan and Holmes, in behalf of the work done at the University of Michigan and the College of Physicians and Surgeons of Chicago, respectively, show the interest which is taken in this subject in many of the Western schools. General chemistry forms so large a part of the first year's work in the Harvard Medical School that it is proposed to make room for other valuable work by making this study one of the requirements of admission. This course is already anticipated by most of the college graduates. The course on embryology and histology is at present required and lasts throughout the year. Students are obliged

[1] Ideals of Medical Education, 1891

to keep books in which drawings are made of the specimens studied, and these books are examined by the teacher. Those who do not possess microscopes are provided with them by the school, and the equipment of this department enables it to handle classes of 150 students. Prof. Minot, who conducts this course, urges the addition of a course on biology to the work of the first year, as it would not only enable the student to pursue many of his studies more intelligently, but would add greatly to the value of all original work done by the student or physician. The new four years' course has been so arranged that the technique of bacteriology comes in the first year. This is a time when the student has more time for laboratory work, and it paves the way for special work in the study of these organisms in connection with pathology, which is placed in the second year. I shall leave a more detailed statement to Prof. Ernst, who will have something to say upon this subject later. Bacteriology needs no special plea to-day. It can not even be regarded as a purely scientific study. No practitioner of medicine or surgery who emerges from one of our schools to-day should be considered properly equipped for his work unless he has been trained in such a laboratory. No physician can expect to unravel the secrets of disease without a practical knowledge of the demonstration of certain forms of bacteria, and there is certainly no better school for aseptic surgery than the bacteriological laboratory. The study of pathology at the Harvard Medical School [1] is conducted by Prof. Councilman, not only by lectures, but by demonstrations, recitations, and exercises in pathological histology. The latter course, which has hitherto been optional, is now obligatory. The relation of bacteria to disease is taught by the study of certain types of disease, as tuberculosis, suppuration, pneumonia, etc. Demonstrations are given twice a week of material obtained from the hospitals and from private practitioners. This is a laboratory exercise. Members of the class are called upon to study the specimens. He then carries around to the other members of the class and demonstrates and explains to them the lesions. Each student in this way has the specimen demonstrated to him. In the course on pathological histology the student is required to make drawings of the sections studied, and opportunity is given to a certain number of men who have gone through with the course in pathology to act as demonstrators the following year and to assist in teaching. Places are assigned in the pathological laboratory to a certain number of students who have done well in their studies, and opportunity is given them for special study or original investigation.

A type of laboratory course, which I think is peculiar to Harvard, is that on the application of bandages and surgical apparatus. It is a purely laboratory course, is given to students at the beginning of their second year, and is confined to a detailed study and drill in the practical part of such work. Bandaging is taught upon the living subject and a few wooden models. The feature of this course which is perhaps most valuable is the preparation and application of all the forms of stiff bandages. In this way every member of the class learns thoroughly the elementary part of this work before he begins to practice upon patients in the hospital, and no student leaves the school without becoming an adept in the application of the stiff bandage.

Another subject which is receiving more and more attention yearly is that of clinical instruction. The weakness of this feature of medical education was one of the glaring faults of the old system and arose out of the fact that hospitals were far less numerous than they are at the present time, and that from the necessities of the situation the independent origin of the medical school became a custom which has continued almost unimpaired to the present day. In Boston the medical school flourished for nearly one-third of a century before its teachers realized the impor-

[1] Bulletin of the Harvard Medical School Association, No. 4.

tance of this problem. A circular was then issued, in 1810, in which the statement was made that "a hospital is an institution absolutely essential to a medical school." Would that all teachers of that time had realized sufficiently that fact and had educated the public to recognize the necessity of such a close relation of the two. Many of the older members of this congress can remember the old-fashioned prejudice which resented the intrusion of students into the hospital wards. The theory of the trustee of that time was "this money was given for the cure of patients and not for the education of physicians." They could not be persuaded that the two interests were identical. The change of feeling in more enlightened times was indicated by the benefactor of the great Johns Hopkins Hospital. At the opening of that hospital in 1889 Dr. Billings showed the advantage of such an union in the following words:

It is well known to those familiar with the subject that the sick in a hospital where medical instruction is given receive more constant, careful, and thoughtful attention than do those in a hospital where no such instruction is given. The clinical teacher must do his best. Keen eyes will note every error in diagnosis, every failure in the results of treatment. Moreover, the very act of teaching clarifies and crystallizes his own knowledge; in attempting to explain, the dark places become prominent and demand investigation, and hence it is that those cases which are lectured on receive the best treatment. I need say nothing here on the other side of the question, the value of properly-trained physicians to the community and the necessity for hospital instruction in such training. Johns Hopkins understood all this, and specially directed that "in all your arrangements in relation to this hospital you will bear constantly in mind that it is my wish and purpose that the institution shall ultimately form a part of the medical school of the university."

The reaction in favor of clinical teaching is becoming daily stronger, and no school can hope to compete with the great schools of the country which does not have control of what is usually called "clinical facilities." This term must, unfortunately, still be used; for the number of schools which have hospitals of their own is yet exceedingly small. The union between the two is in most of our large cities becoming a more and more intimate one. Another immense advantage which the possession of a hospital gives to a faculty is the control of appointments. Most schools are now obliged to select their teachers from members of the staffs of hospitals in their city who have services at times of the year which enable them to teach. These individuals are appointed by laymen who have no knowledge and no regard for the necessities of medical education. Faculties thus placed are unable to select teachers of national reputation, as there is no appointing power which enables them to give such a person the material with which to teach. This is a grave defect in our system, and one which the leaders in medical education should not forget to impress upon the profession and the public. But while applauding the movement in favor of clinical teaching, it is perhaps well at the present time to consider whether systematic or, as it is usually incorrectly called, "didactic" teaching should be abandoned. The discussion as carried on in the medical journals appears to lean in this direction. A course of systematic lectures enables the teacher to cover ground which he would be unable to do even in a clinic most richly endowed with material. The method of handling the subject differs entirely from that adopted at the bedside, and in a well-regulated four-years' course I believe the systematic lecture should still retain a prominent place. Clinical instruction should be abundant, and of the most varied kind. Instruction of the class in small sections is a most desirable feature of this department. It involves a greater expenditure of time and an increase in the teaching staff and great ability as an organizer in the head of the department. It is the squad drill, however, which brings the student in most intimate contact with disease. To carry out these ideals necessitates a "plant" far in advance of that which the average school now possesses. No such enterprise can be undertaken without

that aid which has hitherto been conspicuous by its absence. I refer to endowments. The valuable paper of Dr. Bayard Holmes, already referred to, gives some interesting data on this subject. He says:

The productive funds in the hands of medical schools, both those connected with and those independent of universities in the United States, was, in 1889, $249,200, while at the same time there was in the hands of schools of theology productive funds to the amount of $11,939,631. The value of buildings and grounds used by medical schools at the same time was $4,047,618, and the theological schools were accommodated with buildings and grounds valued at $7,762,095. * * * The medical schools had, in 1889, 12,238 students, who paid tuitions to the amount of $763,761, while at the same time the theological schools enrolled 6,989 students. I am able to reinforce these figures by an abstract of the statistics for medicine, theology, and technology as reported to the bureau in June, 1892. The medical schools possessed buildings and grounds in 1892 valued at $7,507,937, and productive funds amounting to $611,214. Medical departments of State universities also received State aid in 1892 amounting to $40,500, which, if capitalized at 5 per cent, would be equal to an endowment of $810,000; making a total endowment of $1,421,214. There were 16,731 medical students in attendance. The theological schools report productive funds amounting to $17,599,979, and stated, at the same time, the value of their buildings and grounds was $10,720,860. They had 7,672 students in attendance. Technological schools report productive funds amounting to $13,229,940. These institutions received from State appropriations or municipal aid, in 1891–'92, $747,504, which, if capitalized at 5 per cent, would be equivalent to an endowment of $14,950,080; making a total endowment for schools of technology of $28,180,020. There were enrolled in the schools of technology 10,921 students, about one-third of whom were in preparatory courses. It will thus be seen that the endowment of theology is increasing at the rate of about $2,000,000 a year. The technological schools are well provided for, but medicine has scarcely raised its endowment, even at the most liberal estimate, to a million and a half.

Probably the available funds procured by our medical schools are somewhat larger than these statistics show, but they give the proportions which are needed to impress upon us how little financial encouragement medicine receives. When we realize what a valuable factor the medical man is in the rapidly increasing development of the territory of a vast and prosperous country like ours, it seems as if his claims to receive encouragement should be listened to. He does not build railroads or organize societies in new lands, but he is in the foremost rank of pioneers. With the complete equipment which our teachers can give him to-day he becomes a most valuable member of society. He protects the young colony from epidemics; without him State medicine could not exist, and States could not be founded on a basis which would insure prosperity. These ideas should be impressed upon our men of wealth and upon the State governments as well. In the meantime it is important that we should adopt as a principle in our new departure in education that the medical faculty should have personal control of hospital wards and management. Let this work begin in a small way at first, but with a view to future development. Such a change can only be brought about by a slow process of evolution. The sooner, therefore, the principle is recognized and adopted, the better. It is difficult for a prosperous school, which has abundant opportunities for bedside teaching, to realize this, but it can not develop beyond a certain point until it has established its own independence. I can not help believing that in this direction lies one of the greatest avenues of development of our system of medical education in the future.

PAPERS READ BEFORE THE SECTION.

THE IMPORTANCE OF PHYSIOLOGICAL CHEMISTRY AS A PART OF MEDICAL EDUCATION.

By R. H. CHITTENDEN, Ph. D.,

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In this age of progression, when the attention of the medical profession is being directed toward a broader and more comprehensive system of medical education, it is well to consider some of the claims presented by physiological chemistry to occupy a prominent place in the medical curriculum of the day or, if not as an integral part of medical study itself, as a fundamental part of that preparatory training which all progressive minds in the medical profession consider as so important for the most complete and intelligent understanding of the science of medicine in its broadest sense. There can be, I think, no objection from any quarter to the general statement that biology, together with chemistry and physics, constitutes the best and most natural line of preparatory work for the medical student. Indeed, it may well be questioned, whether physics, chemistry, and a certain amount of biology should not form a necessary part of the training of any person seeking a liberal education. To be sure, the intending medical student may well pursue these subjects much more thoroughly than one who desires general training rather than special knowledge. The biological sciences, however, so closely underlie the science of medicine, are so plainly the substructure on which the latter rests, that one can hardly conceive of a broad and intelligent comprehension of the subject without a preliminary training in some one or more of the biological sciences. Just here, however, in order to prevent any possible misunderstanding, let me at once emphasize the fact that what is required first of all of a medical student, as well as of a student in any department of learning, is a broad and well-developed mind, trained to habits of thought and observation, endowed with the power of logical reasoning, and fully alive to the necessity for broad and liberal culture. This is obviously the first requisite, and it is folly to assume that a limited biological training, although valuable in itself, can counteract the defects or make good the deficiences incidental to the lack of intellectual development. A boy fresh from the district school, or from the high schools of our cities, with his mind mostly unformed, is neither fit for the study of medicine nor of any other profession. What he requires first of all is mental training. We need not discuss here whether such training should be obtained through classical studies or through mathematics and the natural sciences. It is sufficient for present purposes that the need for general training be widely recognized. Let it be understood that the medical profession demands men of high intellectual attainments, broad and scholarly, and that there is no short road of preparation for medical studies, through biological or other channels, any more than for the professions of law, theology, art, or literature. Granting all this, as everyone interested in the future development of medicine must, we come back to our starting point, viz., that biology constitutes one of the most important, if not *the* important, preparatory study in medical education. Biology treats of the science of life, of the structure and function of living organisms, high and low in the scale. What more natural and appropriate, therefore, than that the student, aiming to make his life work the study and treatment of the diseased human body, should turn to the study of animal and vegetable forms in order to gain knowledge and experience of the general laws regulating life in all its phases. It is only by a

close scrutiny of the simpler forms of life that we obtain the requisite knowledge to unravel the complexities of structure and function characteristic of the more highly developed human organism. The broad line of demarcation, formerly drawn between the life processes of animals and plants, has been gradually growing narrower and more indistinct, until to-day we are forced to believe in the existence of essentially the same kind of protoplasm (i. e., containing essentially the same chemical substances) in animal and vegetable cells alike, and without regard to the position they occupy in the scale of life, whether in man or in the highest or lowest animals and plants. This naturally leads to the view "that definite fundamental chemical formations and changes are common to all living beings,"[1] and although there are many superficial as well as fundamental differences between the different classes and orders of animals and plants, yet it is evident "that many processes can take place according to a conformable fundamental type. Further, in the life processes of man these parallels are again found, whose simplest manifestation we perhaps follow with the least difficulty in the lowest organisms. We are thus brought to a definite unity in the original structure and processes of living existence."[1] "All living beings, of form and life phenomena the most widely different, appear to owe their fundamental structure to an original chemical organization, with properties common to them all,"[1] from which we can see direct gain to the medical student in the study of lower forms of animal and vegetable life. Further, as an indirect gain, it must not be overlooked that in such lines of biological inquiry the student, while acquiring a fund of useful information more or less directly applicable to his everyday needs, undergoes a training, the value of which can not be overestimated. His powers of observation are called into play, the habit of drawing deductions from observed facts, the noting of resemblances and differences, all tend to educate him in methods of exact work, and lead eventually to habits of self-reliance and a freedom from prejudice and preconceived opinions, which will prove of inestimable value in his after life of practice by the bedside. He learns to appreciate the significance of small things, and becomes thereby well trained in the essentials of accurate diagnosis in a manner which can not be imitated by text-book instruction in any branch of knowledge. He must be taught to observe accurately, and being possessed of reasoning powers soon acquires the habit of close and logical reasoning. All this, I take it, will be readily granted by the unprejudiced mind, but the question naturally presents itself here as to what is meant by or included under the term of "biology." We need not stop for a scientific definition of biology, for our interest centers rather in the interpretation of the word as applied to biological courses of instruction. Judging from the courses offered by most of our institutions of learning under the head of biology, the latter ordinarily includes more or less zoölogy and botany, with a comparatively large amount of dissection of typical forms. This is coupled with a certain amount of histology, and perhaps embryolgoy, all being intended to constitute a more or less thorough presentation of the morphological side of biology. Less thoroughly presented, ordinarily, is the physiological side. To be sure, physiology is usually found as a part of the curriculum of a biological course, but seldom is it taught other than by text-book or with that degree of thoroughness characteristic of morphological instruction. Further, in those institutions where physiology is given a prominent place in the biological course, it is usually a one-sided presentation of the subject. It consists mostly of muscle and nerve physiology, with demonstrations of blood pressure and kindred experiments, designed to illustrate mainly the mechanical side of physiology. I would not be considered for one moment as saying a single word against such lines of

[1] Hoppe-Seyler's address on "The Development of Physiological Chemistry and Its Significance in Medicine."

physiological experimentation or instruction; it is certainly of the highest importance and, in my judgment, is just what is needed in every course of physiological study. But what I would like to impress upon my hearers is that there is another side of physiology which, in this country at least, has not been cultivated as it should be, viz., the chemical side of physiology, or physiological chemistry. It deals with quite a different series of problems from those pertaining to so-called pure physiology, but I venture to say that the phases of physiological study and investigation it presents to us are as fundamental, if not more so, than any other single line of physiological work. By physiological chemistry I mean something more than the mere application of chemical analysis to a determination of composition. This, to be sure, is important; but more valuable still is a proper understanding of the processes or lines of functional activity going on in the organs and fluids of the body, a rightful interpretation of which, however, must depend greatly upon our knowledge of the composition of the various parts of the body and upon the chemical constitution of the many organic substances disseminated through the organism. Physiological function depends largely, if not wholly, upon chemical nature and constitution, and although there is much that is vague and incomplete in our knowledge of the chemistry of the body, it is very evident that such chemical information as is obtainable is a necessary preliminary to all physiological study. Indeed, there is hardly a question, either in physiology or in the science or practice of medicine, which does not draw, to a greater or less extent, upon physiological chemistry for its solution.

As I am now addressing a body of physicians rather than physiologists, I can not do better than to repeat a remark of Prof. Hoppe-Seyler's, taken from an address on the development of physiological chemistry, as illustrative of the important position this well-known authority considers this branch of chemistry should occupy in the medical curriculum. "I can not understand," he states, "how at the present day a physician can recognize, follow in their course, and suitably treat diseases of the stomach and alimentary tract, of the blood, liver, kidneys, and urinary passages, and the different forms of poisoning; how he can suitably regulate the diet in these and in constitutional diseases without knowledge of the methods of physiological chemistry and of its decisions on questions offering themselves for solution, and without practical training in their application." Again, Leube, the noted clinician, exclaims against the underestimation of physiological chemistry in medicine, and emphasizes the probability that the future success of medicine is dependent mainly upon the advancement of this branch of chemistry. In every medical school in the land there should be a well-appointed laboratory for the practice and study of physiological chemistry in every direction bearing on medical science. So, too, in every well-rounded biological course there should be ample facilities for instruction and experimentation, not only in pure physiology, but likewise in physiological chemistry, so that a broader and clearer conception of physiology may be obtained than is possible by the presentation of a single side of the subject. Obviously, in a course of biological instruction the morphological side rightly receives the first attention; form and structure must be first studied, and thoroughly studied, but chemical composition and function are not to be entirely ignored. So, too, in medicine, the unsymmetrical development, especially of the last twenty years, by which the sovereignty of morphology has been attained, giving undue weight to anatomical methods of investigation, has reached its climax, and the clinicians even are now looking to physiological chemistry to aid them in unraveling many of the hidden processes of life, thus hoping to gain clues to clearer methods of diagnosis and more rational lines of treatment. And yet our medical schools are sadly lacking in facilities for teaching, as it should be taught, this important branch of science. Contrast, for example, the time allotted and the facilities afforded for studying

physiological chemistry with the time and facilities given to anatomy, histology, and pathology. The difference is appalling, and I say it with all due respect to the position these three subjects justly occupy in the medical curriculum, and with, I think, a due appreciation of the great gain accruing to medicine from the marvelous development of pathological investigation which has been witnessed during the last two decades. If, however, a small fraction of the time and energy given to these branches of medicine had been devoted to the simultaneous study and investigation of the chemical processes of the body in health and disease, I am sure equally important results would have been obtained, and as a final outcome a far more satisfactory explanation of many phenomena, for which anatomy, histology, and pathology alone have thus far given only incomplete or unsatisfactory explanations. It is from a judicious combination of the results obtainable by different lines of inquiry that the broadest and most definite, as well as the most accurate, deductions are to be drawn. From the very nature of things no one branch of biology, no one branch of medicine, is capable of affording as complete and satisfactory answers to the many general questions constantly arising as can be furnished by broader and more comprehensive methods of work.

Let us consider now for a moment some of the reasons for our belief that physiology and medicine are greatly indebted to physiological chemistry for their advancement. Obviously, in the first place, we must remember that our knowledge of the composition of the tissues, organs, and fluids of the organism, whether animal or vegetable, is derived entirely from chemical study and investigation. This is plainly self-evident; but when we consider how far-reaching are the facts thus obtained in promoting our understanding of the laws of growth of the human body, of the relationships of the various physiologically active and inactive tissues, of their development, of the character and extent of their activity, and of all the variations incidental to pathological conditions, we see at once the great importance of this knowledge in aiding us to a rightful interpretation of physiological laws. The great progress made of late years in our knowledge of the various digestive juices of the body, of their mode of action, of the character of the products resulting from the digestion of the various classes of food stuffs, of the conditions favorable and unfavorable to fermentation; these and many other things connected with the study of digestion in its broadest sense have all been accomplished as the result of long-continued and laborious experimentation in the domain of physiological chemistry; results that have not only helped to give us broader and clearer ideas of the physiology of digestion, but have made possible much of the advance in the diagnosis and treatment of disorders of the alimentary tract. Take from us our knowledge of the chemical composition of muscle and nerve tissue, and of the characteristics of the various substances entering into their structure, and what a blank would remain. Consider the importance of our ever-growing knowledge regarding the chemical changes going on in the two master tissues of the body, with their influence on heat production and on proteid and other forms of metabolism, and remember at the same time that, in spite of all that has been accomplished in the past, we have hardly passed the threshold of the possibilities opening up before us. Then, too, the whole broad question of nutrition in general, with its bearing on health and disease; the study of the urine and fæces, with the rich results such study affords as a means of diagnosis; the study of the liver and its secretion, the bile—all are in great part chemical problems, partial solution of which has already afforded results of inestimable value. Then consider for a moment the part chemistry has played in bringing about our present understanding of the manner in which microörganisms act in the animal body, with its bearing upon the whole question of infectious diseases, the discovery of the production of distinct chemical poisons by specific pathogenic bacteria, with the impetus this fact has given to the search for methods of producing immunity.

Then, too, we must not forget to recall the great aid chemistry has lent to therapeutics, giving us not only methods for the preparation of purer and more definite products, but opening up methods of studying the physiological action of drugs, which has greatly advanced the growth of scientific pharmacology.

In the brief time allotted for this paper we can not, however, even mention further specific instances of the way in which physiological chemistry touches and strengthens almost every department of medicine. I would that I had time to sketch for you a more detailed picture of this whole matter as it presents itself to my own mind, for I am sure that by so doing it would be possible to impress you more fully with the great need of broader and more liberal methods of instruction in this department of science, both as an aid to a better interpretation of biological laws and as a necessary part of a liberal medical education. And now allow me to say a word regarding the methods of instruction in physiological chemistry. Happily, the day is past when a medical student is compelled to obtain his knowledge of medicine from lectures, or even from books alone. Personal instruction and personal experience in the laboratory are essential requisites in any course of instruction that aims at the highest and best results. So, in physiological chemistry, there must be a well-equipped laboratory, where each student is provided with the necessary space and outfit for demonstrating the fundamental truths of chemical physiology. Instructors, too, must be provided so that at the most not more than fifteen men shall be under the guidance of one teacher, who shall thereby have time and opportunity to study and develop the material committed to his charge to the fullest extent. For men's minds, as you well know, are not all constructed on the same plan, and personal idiosyncrasies need to be recognized and dealt with in such a manner that each may receive the full benefit of the knowledge and training provided. A course in physiological chemistry worthy of the name should extend through at least six months, and preferably through a whole year, with an average of fifteen hours of laboratory work per week, interspersed with lectures, recitations, and demonstrations. Such a course of instruction as I have in mind can be advantageously taken only by men who already have knowledge of general, analytical, and organic chemistry, physics, anatomy, and histology, together with more or less familiarity with general physiology. You say, perhaps, that no medical student can afford to spend such an amount of time on a subject only indirectly connected with medicine. But I believe that to be a grave mistake, one that is in part responsible for the large number of half-educated men in the medical profession. As Dr. Billings, in a recent paper in the Forum on "Medicine as a Career," has well said: "This country is in no need of men possessing the diploma of doctor of medicine; it already has at least 20,000 more of them than it requires or can properly support; but it does need several hundred, say 1,000, more of properly trained physicians." An experience of eighteen years in a large university in teaching physiological chemistry as a part of a biological course having for its chief aim the preparation of young men for the study of medicine has convinced me that the time spent in such study is well spent, and that such a line of work can be advantageously made a part of the university or college curriculum, so that the intending medical student may have a fundamental idea of the scope and aim of physiological chemistry before he enters upon his medical course proper, just as he has, or should have, a knowledge of comparative anatomy, physiology, and general biology. But the medical school itself can well afford to establish a thorough course in this subject; indeed, no medical school at the present day can afford to to be without such a course of study if it hopes to rank with the leading institutions of the land, or aims to provide instruction of the highest and fullest type.

And now just a word or two regarding the character of a course in physiological chemistry. There may obviously be different views upon this subject. I can

simply present my own. First, I believe that the student should be taught, in the laboratory, of course, the general reactions and properties of the various albuminous or proteid bodies, studying likewise their more common decomposition products, their relationship and chemical constitution, so far as known. Next in order come the various forms of epithelial and connective tissue, the student separating for himself and studying the various albuminoids which give character to the respective tissues, as the collagen of white fibrous tissue and the gelatin derived from it, the elastin of yellow elastic tissue, the so-called chondrin from cartilage, together with mucin and neuclo-albumin from the mucous tissues. Adipose tissue naturally comes next, and the several fatty acids are separated and studied, melting points determined, and the differences between the natural fats noted. This preliminary work, which involves much more chemistry than can be readily indicated by this short description, is followed by a study of the more important muscle tissue; the properties of muscle-plasma and muscle-serum are noted, and the various proteids and crystalline extractives characteristic of this tissue are prepared and examined. Myosin, the proteid of muscle clot, is especially studied, and its resemblance to the related globulins of blood-plasma noted. Again, it must not be forgotten that in order to make such a course as I am outlining of the highest value no opportunity should be lost to show the physiological bearing of all the results obtained; to try and instill into the mind of the student the idea that the facts of physiological chemistry have a wide application. Thus, in the chemical study of muscle tissue, for example, many lectures and recitations may properly be interspersed, sections, for instance, from Foster's Physiology making an admirable addition to the laboratory work; the object being to teach the student to make use of physiological chemistry as a means toward a broader and more accurate conception of physiological phenomena. Muscle tissue is followed by a study of nerve tissue, the various bodies especially characteristic of this tissue, such as lecithin, myelin, cerebrin, protagon, and cholesterin, being separated and their general properties and reactions ascertained. The chemical differences between the gray and white matter are also noted, the neuroglia, neuro-keratin, and brain proteids are studied, while chemical and anatomical relationships are compared in this as in all other tissues examined. The study of digestion is taken up next, the various secretions, salivary, gastric, pancreatic, and intestinal, being thoroughly examined. Artificial digestive juices are prepared, and their action on the various classes of food stuffs noted and compared, this serving likewise to illustrate the general action of enzymes or soluble ferments in distinction from the organized ferments. The many products of amylolytic and proteolytic digestion are prepared and separated, their chemical and physiological properties ascertained, and a thorough study made of both the chemical and physiological side of digestion in its broadest sense, it being the writer's custom at this point to have the students study and recite, in connection with their laboratory work, nearly all of Book Second of Foster's Physiology, which treats especially of the tissues of chemical action with their respective mechanisms, and of nutrition in general. In a similar manner the liver with its secretion, the bile, glycogen, and glycogenesis, the spleen, blood, milk, and urine are all studied, and the proximate principles giving character to the several organs and secretions separated and examined. Further, the metabolic activity of the hepatic cells, and likewise of the kidney cells, is demonstrated by appropriate tests, such as the synthetical production of hippuric acid through the agency of the cells of the tubuli uriniferi. The chemical changes incidental to respiration are also experimentally studied, and the detection of blood stains by spectroscopic and other methods duly considered. To the urine special attention is given, students being taught not only to make examinations of this important excretion but likewise to determine quantitatively the urea, uric acid, phosphates, chlorine, sulphates,

combined sulphuric acid, hippuric acid, creatinin, indican, sugar, albumin, and other abnormal constituents. Further, by daily quantitative examinations of the twenty-four hours' urine, opportunity is given to demonstrate many of the truths of nutrition or general metabolism, such as the influence of various forms of diet on the excretion of urea, uric acid, phosphoric acid, and combined sulphuric acid, the influence of drugs on proteid metabolism, etc.

This outlines very briefly the general character of a course in physiological chemistry such as I would see open to every student of medicine. To one interested in this phase of physiological work, such a course of study would naturally serve as a preliminary to more advanced work, which might readily deal with many interesting problems bearing directly upon medicine and medical practice. There is, in fact, almost no limit to the many questions constantly arising which demand the aid of physiological chemistry for their solution.

METHODS OF TEACHING CLINICAL MEDICINE.

By FREDERICK C. SHATTUCK, M. D., of Boston, Mass.

Whether there is anything perfect in this world, I do not know. That it is possible to improve the teaching of clinical medicine, in this country at least, I feel quite sure; at the same time also I recognize the advance which is certainly being made, and am convinced that the advance will continue. We believe that the best is none too good for us, and propose to have it. To hasten and secure progress in the future it is well to understand and consider the past and the line along which evolution has worked to bring us where we are. We must also bear in mind the local conditions, with the advantages and disadvantages which they entail. The problems are: To make the best of what we have got, to get more, and gradually to surmount the bars to progress, whether these are accidental or inherent in the spirit and institutions of the country. It is easy enough to see the advantages of governmental control of the higher education, as exemplified in European countries. Professors are government officers; hospitals and laboratories are built and maintained by the state. All the parts which go to make a complete medical school should therefore work together like the parts of a machine, well oiled by national appropriations. But it is not likely that we shall see any general adoption of this system, or anything similar to it, in this country, even if it were desirable that we should. While the town or municipality properly insists on and provides for primary education with us, intelligent private liberality must in the future, as it has done in the past, provide in the main for the endowment of advanced and professional education. Laboratories of all kinds, including hospitals, cost so much to build and maintain that no medical school can pay its bills from the tuition fees of its students, even if a self-denying and devoted faculty is willing to forego all direct pecuniary returns. It is to the honor of this country and of American public spirit that there are good medical schools, the teachers in which have from the start adopted this unselfish plan of devoting every cent of surplus to improving the facilities for teaching. Without endowment it is impossible to provide all that is needed. Endowments will not flow toward proprietary schools which are exposed to more temptation than is desirable toward a lowering or half enforcement of standards. They will, however, flow to schools which are really parts of universities; and I believe that we can rely absolutely on the intelligent private liberality of our citizens to provide all that is required. But we must make our wants known, and indicate the means by which they can be best supplied. Everything comes to him who waits.

Allow me now rapidly to touch on the beginnings of medical education in thi country and the manner of its growth. Roughly speaking, a century ago w became an independent people, full of vital energy, and with ample opportunitie for its exercise in the development of a vast and rich territory. During the colo nial days we looked to the parent country for professional education, as well as fo many other things. With independence came an increased stimulus to provid more fully for ourselves. The medical school of the University of Pennsylvani had been already started. That of Harvard began in 1783, with three professor Other schools gradually followed. Medical education before this was obtaine entirely from a preceptor, whose students compounded his pills and draught read such books as he had, drove about with him on his rounds, and assisted hi in many ways, even to the care of his horse perhaps. For many years after th establishment of medical schools clinical teaching remained in the hands of th preceptor. But it marked a distinct advance when opportunities were offered t enlarge the minds of students by coming to a city and hearing the leading fac and theories of medicine set forth by men of large and varied experienc Clinical teaching was then wholly derived from the private practice of the pr ceptor; systematic and didactic teaching formed the lecture course of the medic school. The number of men who could get their professional education, in who or in part, in European capitals was very small. The medical school was a pr vate institution, responsible to no one in theory, though the board of trustees eminent laymen, chosen to add respectability and éclat to the enterprise, som times proved to be masters where they were intended to be servants. Or affili tion was sought with some existing university. But this connection was gene ally a loose one, the university practically doing nothing but confering the degre on those recommended by the medical faculty. The schools were essentially propr etary. This was the case at Harvard until twenty years ago, when the uni became real and organic. It is only two years since the College of Physicians a Surgeons of New York became really a part of Columbia College. Medical scho antedated hospitals. The largest cities in the country one hundred years ago we small, the population was practically native, and there were very few poor requi ing hospital treatment. The development of hospitals in this country practical is included within fifty years, when the stream of immigration began to chan from a brook to a river. Medical schools being essentially proprietary, and bei active only a few months in the year, hospitals were a separate foundation a grew up under separate management, a misfortune which, perhaps, could not ha been avoided under the circumstances; but a great misfortune nevertheless, a one which still weighs heavily on the great majority of the schools of the countr Medical schools were founded by physicians, hospitals by benevolent layme always, it is true, with the active coöperation and oftentimes distinctly as a resu of professional influence. But they were under separate management, and it w natural enough that laymen should consider the introduction of students in a h pital as a drawback rather than a help to the patients, and that they should unwilling to hand over the hospitals to a proprietary medical school, which cou give no guaranty of permanency or of reasonable freedom from selfish actio Under this mode of hospital foundation the service was divided up among t leading or most active medical men of the town or city. If a teacher had a se ice of three or four months, the duration of an old-fashioned lecture term, was satisfied. Indeed he, in common with the non-teachers, preferred a short ter as allowing more time for private practice, the emoluments of which he require as those of his teaching position were indirect and uncertain. Thus arose a seco great drawback to clinical teaching; a drawback which is more felt now that t older schools undertake to furnish entirely, or in much larger measure than formerl the bedside instruction of the old preceptor. In a word, then, the two chief diffic

ties with which we have to contend in this country in developing first-rate and sufficient clinical teaching are the lack of complete union between medical schools and hospitals and the system of broken hospital service. Another and incidental disadvantage is the impossibility of calling clinical teachers from other places. In the purely scientific branches it is a matter of providing a salary; but the school which does not own its hospital can not provide the clinical teacher with a hospital service. It will, of course, be understood that I am speaking broadly. There are schools in this country which own their own hospitals and can regulate the terms of service therein. But I think I am safe in stating that with the possible exception of McGill University, in Montreal, there is not a single one of the leading schools which absolutely controls sufficient clinical material for the methods of clinical teaching which prevail at present, much less for such methods as we should aim to follow in the future. The Johns Hopkins will start with a clean slate on a proper system, and with every facility for the best and most thorough clinical instruction. All friends of medical education must watch its course with the greatest interest. Its success must stimulate other schools to make more of the advantages which they possess, and must strengthen their hands in the struggle to secure those which they still lack.

It must be added that in spite of the disadvantages under which we labor in this country as a whole, the practical working of things is not so bad as might be expected. The laymen who manage private and endowed hospitals are intelligent men as a rule, and are realizing more and more that the interests of their sick charges, as well as the reputation of their hospitals, are subserved by the instruction which is carried on within their walls. And I can see a current setting toward a diminution in the size of the staff and a consequent lengthening of the term of service. There is much more that might be said, and doubtless better said, on this broad theme of the relation of medical schools to universities and hospitals. It is a fundamental question. If we can secure and control further opportunities for clinical teaching, the subsequent details present no special difficulty.

To a brief consideration of these details I must now pass on. I do not know where and when the first chair of clinical medicine, independent of that of theory and practice, was established in this country, and this little paper is written far from any medical center or books. It is rather less than forty years since the chair was founded at Harvard, and my father was its first occupant. Since this time the increase in the amount of clinical instruction has been, on the whole, steadily progressive. In the twenty-five years which have passed since the writer began to study medicine the number of exercises per week in clinical medicine has been multiplied several times; and the four-years' course, the success of which must depend largely on clinical opportunities of all kinds, is bringing still further increase in amount with, it is hoped, some corresponding improvement in method. The clinical lecture to large classes in the amphitheater, which marked the commencement of instruction in clinical medicine, maintains, and always will maintain, a place. Much instruction can be imparted in this way, with economy of time to the student and of teaching force to the school. However careful and ample the drill of the individual student may be made I believe that the clinical lecture will survive. During a year a wide range of disease, as well as much of the variation of individual diseases, can be illustrated by patients, drawn both from the wards and from the out-patient department. The student is thus shown methods of diagnosis and treatment, his attention is called to the changes in structure and function which disease works in the living body, and the particular case can be made to illustrate general principles. But the work is done for the student, and must be done for him, in the main. The limits of an hour, and the enlistment of the sustained interest of the class as a whole, do not permit the drill of one or two individuals whose profit is largely at the expense of the main body,

In many of the schools of this country clinical lectures to a full class are given i sufficient number and of high quality. What, practically, all the schools nee most is the clinical drill of the individual student and a close contact betwee student and patient. This implies a wealth of clinical material and a considerabl number of instructors, among whom the class can be subdivided so that each ca have the precious opportunity of observing and finding out for himself. The war visit is a valuable means of instruction in rendering it possible to see and follo out diseases and cases of disease which can not well be transported to the amphi theater. But it is hard to make a ward visit profitable to more than a dozen stu dents at once, and the management of an independent hospital is apt to loo askance at a method which tends to increase and complicate the work in the war in ways which it is not necessary to elaborate.

There is one feature in particular of the English system of clinical teachin which has always seemed to the writer most admirable. Each student must serv a certain number of months in the ward as clinical clerk, with certain cases, for th care of which he is responsible under supervision, and with all the details and cours of which he necessarily becomes familiar. It is thus impossible for him to ente practice without any practical experience whatever; and, what is more importan he is forced to exercise his powers of observation for himself. The identity of scho and hospital make this system easily possible. And yet it has not been attempte in European schools to any extent as far as I know. Anatomy can not be learne without dissection, chemistry without laboratory work. Nor can clinical medi cine be learned in the best way without work in a hospital ward and out-patien room. It is possible that much use could be made of the sick poor at their home under the charge of dispensary physicians, though there are practical difficultie in the way. I believe that along this line lies the first present necessity and oppo tunity for development. The recognition of the necessity is the first step towar the provision and utilization of the means. There should, again, be primary a well as advanced clinical instruction. In the new schedule of studies under th four-years' course now in operation in the Harvard school, this principle receive full recognition. The course in the second year is entirely separate from that i the third; that in the third will be more or less independent of that in the fourt year. Each student will have in his second year four hours a week; partly cli ical lectures and demonstrations of semeiology and diagnostic methods, partly dri in small divisions in physical diagnosis, and partly ward visits in the hospital. Th general scheme for the third year is to provide more advanced instruction in th wards and amphitheater, including therapeutics, as illustrated by the case or cas in hand. In the fourth year it will be the aim to make the work as practical a possible, and give the student opportunities to apply and fix the knowledge whic he has already gained at the same time that he increases his stock by more int mate contact with disease.

Many years ago my father introduced an exercise in clinical medicine which ha become popular and been adopted by other departments in the Harvard school, t which it is still, so far as I know, peculiar. It is called the "clinical conference. Each student in his final year is provided with a selected case, usually in a hospita ward, though sometimes in a dispensary district. He is expected to visit and fo low up this patient, and write a practical paper on the diagnosis, prognosis, an treatment. A month or six weeks is allowed for the preparation of the pape which is then handed in and which counts a fraction toward the examination fo the degree. From these papers a selection is made, according to character an subject, and every week one is read by its author before the class and a numb of instructors in the department. The reader is then subjected to criticism an question by his fellow-students and teachers. On the preparation of these cas much pains is bestowed, and I think there can be no question that the exercise

a useful one. It is a matter of honor that the work on the case should be really that of the student himself. Under the four years' course, instead of one I hope that each student may receive a number of cases to look up in this way.

I believe that the future is bright with promise. The progress in a century has been enormous. At first we depended almost wholly on Europe or Great Britain for a first-rate medical education. Then students crossed the water for clinical advantages in hospitals, as these were non-existent or small in this country. Then a prime inducement was the chance for laboratory work—physiological, pathological, histological, and biological. Just as our hospitals have become second to none, so will our scientific laboratories. It will always be enlarging to the mind to visit foreign schools and study their methods. But it is no longer necessary for the attainment of an excellent equipment alike in practical and scientific medicine. We should bear in mind the fact that we have many possessors of large fortunes who can quickly see that in no way can they so usefully and with so much credit to themselves dispose of their surplus as by promoting medical education within as well as outside of hospitals. But the matter must be laid before them, as it can not be expected that they should be familiar with the requirements of clinical teaching. Who is so fit to explain the matter and can exert more influence than the family physician? Even if a teacher himself he can not be considered a specially interested party if he is an officer of a university, which goes on forever, and the management of which can be depended on to administer funds intrusted to it strictly within the purposes and wishes of the donor.

A DEMONSTRATION OF THE CÆSAREAN AND THE PORRO OPERATIONS.

By GUSTAVE ZINKE, M. D., of Cincinnati, Ohio.

This includes: (*a*) Preparation of the patient, her bed, and room in which the operation is to be performed. (*b*) What anæsthetic shall be employed? (*c*) What instruments and other articles are necessary for the operation? (*d*) Best time for the operation. (*e*) The operation itself. (*f*) The after treatment.

(*a*) Much will depend upon when, where, and how we find the patient; whether she be in the country, town, or city; whether she is already in labor, and whether her condition is such as to demand prompt interference, with little or no time left for preparation. But it should always be remembered that an aseptic condition of the mother, as well as of the operator, his assistants, and instruments, are most essential to success. Whatever little time the operator may have at his disposal should be employed in washing thoroughly, with soap and water, those parts of the mother's body which are concerned in the operation. The instruments, too, as well as the hands of the operator and his assistants, should receive thorough aseptic treatment. Antiseptics play an all-important part under such circumstances. The rest, such as cleansing the patient's body, changing her clothes on the bed, and cleaning the room, all may, in an emergency, be postponed until after the operation. If the case comes under observation at a period of gestation which gives time for preparation, say a few days, weeks, or a month or more, nothing should be left undone that may render the patient and her surroundings most favorable under the circumstances. If she can be removed to a special hospital, one devoted to abdominal surgery, it should be done. A general, especially a public, hospital should be avoided; unless it be provided with a building and an operating-room appointed and set apart especially for work of this kind. There can be no doubt the chances for recovery are much better in special hospitals. The patient's home, though the humblest in the world, is

preferable for the performance of the operation to a hospital filled with patie of every description and having but one operating room. The question of p mature delivery is hardly to be considered here, since it is self-evident that if t patient can be safely delivered of a seven or eight months' child this procedu should be adopted in preference to Cæsarean section. As soon as the performan of hysterotomy has been determined upon, whether in a hospital or at the ho of the patient, every precaution should be used for the purpose of insuring safe Thus it will be well if the patient receive a daily vaginal douche ($\frac{1}{4000}$ solution bichloride), a warm bath, and a change of underwear for several days prior to t operation. Saline cathartics are the best for the purpose of securing free a daily evacuations. Rectal injections of tepid water will assist in relieving t bowels of their contents. On the evening before, the abdomen, mons veneris, a labia should be shaved, and an abdominal binder with perineal pad, antiseptica prepared, should be applied. The bed which she is to occupy after the operati should also be absolutely clean, the bedstead taken apart and thoroughly scrubb the mattress and bedclothes fumigated, then well aired, sheets and pillowsl rendered aseptic and antiseptic by boiling and subsequent dipping into a $\frac{1}{2}$ bichloride solution before drying. If she is in her own home the same apartme may be used for bed and operating room. The room is to be prepared as follov If walls and ceilings are painted they should be washed; if papered, wiped; neither, whitewashed or whitened. Windows and frames should also be wash and the floor thoroughly scrubbed and subsequently kept sprinkled with a $\frac{1}{2}$ bichloride solution. The temperature of the room should be kept between and 65° F. for at least twenty-four hours prior to and between 70° and 75° duri the operation. A temperature of between 80° and 85° is preferable, for reason that the patient maintains her own temperature better, and consequen the breathing continues more regular, and the heart's action is less apt to fa The operator, his assistants, and the nurse should be strictly aseptic. This mea a bath and clean clothes in the truest sense of the word. No other patie ought to be attended by them previous to the operation. Instruments, spong dressings, and towels must be rendered aseptic and again sterilized before usi Operating gowns or jackets and aprons to be worn by the operator, assistan and nurse should also be sterilized. An ordinary kitchen table, properly clear and supplied with an aseptic blanket or comfort, pillow, rubber and linen she is amply sufficient for the purpose of an operating table. The patient should dressed as "for the night," an undershirt and sleeping gown being all she ong to wear. On the morning of the operation no food is to be permitted, exce perhaps, a small cup of very light coffee and a small piece of toast. Some op ators prohibit even this. Before or while the anæsthetic is administered fr one-eighth to one-fourth of a grain of codeine or morphine may be given subcu neously. Placed upon the table, her clothes are rolled up under her shoulde the lower extremities are wrapped up in warmed, clean blankets, and after antiseptic abdominal dressing, worn by her during the previous night, has b removed and her bladder emptied, towels wrung out in a warm bichloride so tion are so placed across and along the sides of her body as to cover her clot above and the blankets below. The abdomen remains exposed to the operat Enough sterilized water should be on hand for all purposes. The hands of operator and assistants are best rendered aseptic by the method suggested Howard Kelly.

(*b*) The choice of the anæsthetic is left to the operator. After ten years experience in operative work, both as assistant and principal, I have come to conclusion that it is very satisfactory to begin anæsthesia with the use of chlo form, and, after the patient is unconscious, to continue with the A. C. E. mixtu suggested by Reeve, of Dayton, Ohio. When this is followed by a total abstine

from food and drink during the twenty-four hours following the operation there will be but little, often no, disturbance from vomiting.

(*c*) Instruments and other articles necessary for the operation may be briefly enumerated as follows: (1) An ordinary scalpel and elbow scissors for the abdominal incision. (2) A grooved director. (3) A tongue and half a dozen hemostatic forceps (less may answer the purpose). (4) Ligatures of different sizes (silver, silk, silkworm-gut or cat-gut). (5) Needle-holder. (6) Sponges (antiseptic gauze or cotton may take the place of sponges). (7) Rubber tourniquet to throw around the uterus before it is incised (not absolutely necessary). (8) Abdominal irrigator (may not be needed). (9) Iodoform powder; iodoform or antiseptic gauze for dressing the abdominal wound. (10) Adhesive plaster. (11) Abdominal bandage and perineal pad. (12) Hypodermic syringe and whisky or brandy for subcutaneous injections. (13) Hot water bags or bottles.

(*d*) An all-important question is, What is the most favorable time for the operation? Without entering into a discussion of the subjects and citing the different authors and their reasons for selecting either a period immediately before, during, or after dilatation of the os, I will simply state that the most favorable moment for interference is, in my judgment, when the os is sufficiently dilated to admit of a ready discharge of the lochia. If the operation is performed before this stage has been reached the os will have to be dilated artificially. This must necessarily be deficient, to say nothing of the fact that it prolongs and complicates the operation. Still, there may be good reasons for operating earlier, as in the cases of convulsions, or hæmorrhage due to placenta previa or malignant disease of the cervix; or later, as in cases where the contraction at the inlet suggests the possibility of spontaneous or forceps delivery. The various steps of the operation will be shown upon the manikin:

The abdominal incision is made directly in the median line, about 6 inches in length, commencing immediately above the umbilicus, and continued toward the symphysis pubis. It is not absolutely necessary to make the cut directly through the linea alba. Pean and Tait prefer to penetrate the peritoneal cavity just to one or the other side of it. They claim it is difficult to bring and hold in apposition the two aponeurotic edges of the cut, and, if this fail, hernia easily results as a consequence; this can be obviated, it is said, by entering at one side of the linea alba. This argument suggests itself as plausible. After the peritoneal cavity has been reached, the incision is best completed and elongated by the elbow scissors. If it is the aim to eventrate the uterus before incising it, a 6-inch abdominal opening will not suffice. But eventration of the uterus prior to delivery of the child does not commend itself, because it necessitates a very long abdominal incision; again, it is difficult to turn out the uterus, even when the wound is 8 inches in length, nor is there much to be gained by eventration of the organ at this stage of the operation. To prevent excessive hæmorrhage a rubber tourniquet may be thrown around the uterus sufficiently low that no part of the fœtus may come within its grasp. The application of the tourniquet, however, requires the introduction of at least one hand into the peritoneal cavity. It is often difficult, and frequently impossible, to bring the tourniquet into position, and, after this is accomplished, its purpose may be defeated by that part of the fœtus which presents at the os, especially if the membranes have ruptured previously. For these reasons, and the loss of valuable time, the tourniquet is not often employed by experienced operators. Hence, eventration of the uterus, as well as the application of the tourniquet, may be safely omitted during the progress of the operation. After all hæmorrhage from the abdominal wound has been arrested, and three or four sutures introduced in the upper angle of the wound, the ends of which should be fixed by forceps and the loops withdrawn from the wound and retracted upwardly, the operator is ready for the uterine incision. The

uterus, now exposed by the abdominal wound, is to be palpated to determine whether or not the placenta is attached to the anterior uterine wall: if it is, the wall will feel thick, and the parts of the fœtus will not be so easily outlined as when the placenta is not situated in this region. If only a section of the margin of the placenta be present, the incision should be made immediately outside of it. But when the placenta has its attachment, more or less directly upon the anterior wall the incision should be made as nearly as possible in the median line, and from above downward. If the placenta is not present, this is easily done. The womb may first be punctured with a sharp-pointed scalpel and the opening quickly enlarged with a blunt-pointed, curved bistoury. The hæmorrhage which follows, though great, is not as excessive as might be supposed: but when the placenta has been so implanted that even its margin can not be evaded there is nothing to be done but to cut through both structures and deliver as quickly as possible. The extraction of the child is best accomplished by taking hold of one or the other extremity. Some writers have tried to lay down the rule: "Always deliver the head first." Experience has shown that this is not always practicable. In a vertex presentation the hand of the operator would have to pass down over the head to lift it out of the wound. The instant the uterus is opened and the hand introduced, it contracts, the amniotic fluid escapes, and the cavity of the uterus, as well as the wound, rapidly diminishes in size; so that, unless the head is promptly and easily liberated before this occurs considerable force will be required to deliver in this manner: so much so that there is great danger of increasing the length of the wound by rupture in a downward direction, an accident which ought to be avoided for self-evident reasons. When there is a large amount of liquor amnii in a vertex presentation, delivery of the head in advance may, perhaps, be free from difficulty; without it, or when the fluid has already drained off, and the uterus is firmly contracted around the child no risk should be incurred or time wasted in this direction, but delivery effected by the feet. In breech presentations, especially dorso-posterior positions, the head readily finds its way out of the wound; not so, however, when the back of the child presents anteriorly, in which case, for similar reasons, it may be better to deliver by the feet. The only apprehension in a footling Cæsarean delivery is that the uterus may contract around the neck of the child before the head can be removed and thus the life of the child be sacrificed before it is extracted. When this danger is borne in mind, however, the uterine opening may be quickly enlarged by scissors or knife kept ready for the purpose. The same rules which guide us in the delivery of the after-coming head *per vias naturales* should here be observed; the object of which is to throw the smallest diameters of the head across the passage. During delivery of the child eventration of the uterus may be effected and the three sutures, previously introduced into the upper angle of the abdominal wound closed by an assistant to prevent intestinal prolapse. The child delivered, the cord is tied in the ordinary way. The removal of the placenta may be effected by gentle traction upon the cord or, if adherent, the fingers may be introduced into the cavity and the organ separated from its attachment. The uterine cavity is then irrigated and dusted with iodoform powder. Proper suturing of the uterine wound is, next to strict asepsis, the most important features of success in this operation. It consists of bringing the wound together by both deep and superficial sutures. Silk, silver wire, and catgut may be employed for this purpose. Catgut, unless absolutely aseptically and antiseptically prepared, is dangerous for reasons evident to all experienced surgeons; silver wire, because it can not be absorbed, may become a source of irritation and annoyance; silk is, in the opinion of most operators, the most satisfactory, because it creates no irritation and its absorption is only a question of time. The deep sutures should be passed, half an inch apart, through the peritoneal coat and the musculature only. The inner

decidual surface must be avoided in every instance. The superficial sutures are passed between the deep sutures and grasp the peritoneal surface only, after the method of Lambert. The object to be attained is not only to bring the wound surfaces to close and exact apposition, but to cause its peritoneal edges to dip down into the wound, and thus secure a rapid union and prevent oözing from the uterine cavity. The uterus is now dropped back into the abdomen, which, if deemed necessary, may be irrigated with warm, boiled water. The abdominal incision is closed and the toilet made as in an ordinary ovariotomy. As a rule, no drainage tube is needed. A hypodermic injection of the fluid extract of ergot is then made and the patient placed in bed.

The after treatment is very simple: No food or drink during the first twenty-four hours. If food or stimulants are indicated they should be administered *per rectum*, because, if introduced into the stomach, vomiting will probably ensue, and this should be avoided, because of its tendency to disturb a favorable progress of the case. I know of no remedy or precaution which prevents or arrests the often very disturbing vomiting after an operation other than total abstinence from food and drink for a reasonable time after the operation. Opiates should never be given except for severe and continued pain. The bowels should be acted upon promptly if they do not move spontaneously after forty-eight hours. Saline cathartics are the best. The vagina should be antiseptically irrigated three or four times daily during the first few days, and less often thereafter. If all "goes well" the abdominal wound need not be disturbed nor the sutures removed until the seventh day after the operation.

In the presence of a body of medical men, most of whom are general practitioners, it is, I trust, pardonable to have entered into every detail of the operation; and, as many of the specialists and teachers in this department have never had occasion to see or perform the Cæsarean section, I have taken great pains and spared no expense or time to have a manikin constructed upon which this and other operations may be satisfactorily demonstrated for the benefit of students, practitioners, and incipient specialists of obstetrics and gynecology. It is the only manikin of its kind manufactured in this country, and I do not hesitate to say that it is equal to the best manikin made abroad, and in some respects even superior. Upon it the various capital, as well as minor, operations may be executed in a manner approaching real life. If the presentation of this manikin will be a help to the teachers of this branch of the profession its mission will have been fulfilled and the author amply repaid for his trouble.[1]

A CONTRIBUTION TO THE STUDY OF MEDICAL EDUCATION IN THE UNITED STATES.

By BAYARD HOLMES, B. S., M. D., of Chicago, Ill.

An attempt is made to give a brief review of the origin of the American medical colleges, showing that they sprang from a desire on the part of ambitious medical men to advance in this way their own financial interests. This is shown to have been the case especially in a great number of the more recent schools.

The medical schools of the United States are divided into three classes: (1) Those that are under the exclusive control and support of State universities, (2) those that are under the control of university corporations or that maintain a nominal connection with such corporations, and (3) those that maintain no rela-

[1]To the firm of P. Goldsmith & Co., of Covington, Ky., who manufactured this manikin, I wish to express my sincere thanks for the time and patient effort they have so generously expended in its production. They are ready to supply any number of these manikins now, and will promptly fill all orders.

tions whatever to other educational organizations. The advantages and disadvantages of each class are considered separately. Illustrative examples of courses of study and a diagram showing the amount of instruction are presented. The tendencies of development are shown to have been as follows: (1) Medical theories; (2) medical theories plus demonstration of practice in hospitals, dispensaries, and clinics; (3) the application of the best educational methods in studying the theories of medicine and the same methods in the study of clinical material. The schools of the United States are now undergoing development in this last particular by the adoption of laboratory methods of study in all departments of anatomy, pathology, and clinical investigation. The needs of medical schools are shown to lie in improved methods of teaching rather than in better facilities for clinical demonstration; in new laboratories for individual and class instruction rather than in hospitals or laboratories for original research; in paid teachers of physiology, pathology, and clinical chemistry rather than in the extension of surgery, medicine, and obstetrics. Suggestions are made by means of model courses of study, and by means of rules designed to govern examinations and methods of measuring work. The possibilities and limitations of some of these methods are illustrated by the exhibition of class work actually accomplished. The relation of medical schools to hospitals is shown to be less intimate than the requirements of education and the needs of the patients demand. The position of medical courses in all but a few universities, where the control of the medical school is absolutely in the hands of the university, is shown to be less intimate and less rational than that of other departments in the following respects: (1) Admission to the medical school is allowed to the untrained and uncultured; (2) the courses in the medical school do not count in the elective courses for the bachelor's degree or the doctor's degree, save in a few schools; (3) there are no fellowships and no scholarships offered in medicine; (4) The relation of the professors in the medical schools to the trustees and to the treasury of the university are not upon the same basis as that of professors in other post-graduate departments. Relief is to be expected only in the endowment of medical schools either by private individuals or by the State. It is urged that the State should manifest as much interest in the health and food of man as in the health and food of hogs and cattle. Attention is called to the fact that at least $750,000 is annually expended by the General Government on the agricultural experiment stations alone, while not a dollar is spent in medical education. Attention is called to the advantages of State university medical schools in their ability to coöperate with free hospitals supported by the State, the county, and the city, with State boards of health and experiment stations, with the administration of charities, with the administration of tenement and factory inspection, with the reformatory and penal institutions, and with all the many other varied activities of the general and local governments.

THE POSITION OF BACTERIOLOGY IN A MEDICAL EDUCATION AND THE SCOPE OF THE INSTRUCTION.

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In any consideration of the position that bacteriology should occupy in a course of medical education there are two points that must be discussed: First, whether it should come in as a special branch of instruction; second, how much, and when—that is, in what part of the course—should this instruction be given? It is often said that bacteriology can not be separated from pathology; by that meaning that any instruction given in this subject must come into close connection with

and be a part of a course in pathology, and that, in order to a proper understanding of pathology, bacteriology must be taught with it. The same thing may be said, however, and with equal force, of surgery; for no surgeon of to-day has a proper comprehension of any but the mechanical part of his specialty if he be not equipped with a knowledge of the properties of the microörganisms and their activity in the production of the infectious wound diseases. Without this knowledge the application of all the modern methods of aseptic and antiseptic surgery are but the result of rule-of-thumb methods, unworthy of the well-developed surgical mind. The same thing can be said in regard to clinical medicine; the facts that appear to have been developed of late years in regard to many of the diseases falling under this head render it absolutely impossible to intelligently understand and recognize individual cases or great epidemics of these diseases without a proper understanding of their causes, and, as is generally acknowledged, these causes lie especially in the vital processes of the bacteria. So also in hygiene or state medicine, the problems to be studied and solved have to do in many cases with the activity of the bacteria, and can only be rightly understood after a knowledge of these processes has been obtained. To take concrete instances: It may be said, and with much truth, that many of the advances in the management of wounds were made before the present knowledge of the bacteria was obtained. But they were not made before a theory of what their basis was was formulated, and they have been constantly amplified, simplified, and strengthened as the experimental knowledge of the bacteria has increased, so that to-day few of the younger practitioners have ever seen a case of hospital gangrene, which thirty years ago was not an uncommon entry upon the records of many a surgical ward. So, too, has the occurrence of septic diseases following surgical operations diminished in increasing ratio with the increase and spread of the knowledge of bacterial processes, so that it is almost a waste of time to call attention to these facts; but everyone knows with what confidence major operations are undertaken to-day, compared with the feeling of even ten years ago, and everyone knows, too, that the successful result of these operations justifies the confidence with which they are undertaken. This confidence is of course born of the knowledge that the precautions taken as the result of bacteriological research furnish strong safeguards against infection, which is to-day known to be the result of the entrance of a vital principle that it is, theoretically, possible to exclude at all times. Indeed, so far is this extended that, speaking theoretically again, it may be concluded that when infection does occur it is present because of some unseen loophole in the measures taken to guard against it, and it is no longer ascribed to climatic or telluric influences, as used to be the case, although, of course, such influences are not to be entirely excluded. So great, indeed, has been this advance that few of the younger men in our profession even know what Listerism was in its original form, and fewer still would know the uses of the elaborate instruments that were constructed to carry out its principles; instruments that our honored president first brought into the amphitheatre of the Massachusetts General Hospital not so many years ago, and which formed part of the impulse resulting in the great perfection of surgical methods obtaining there to-day. Here, too, should be mentioned the great work done by the obstetricians, for by this branch of the profession were the great principles of infection early applied with tremendous success; so much so, indeed, that it is not an uncommon thing now for a medical student to pass through his instruction in obstetrics without seeing a single case of puerperal fever: and it can never again be said, as did an old writer:

> I arrived at that certainty in the matter that I could venture to foretell what women would be affected with the disease, upon hearing by what midwife they were to be delivered or by what nurse they were to be attended during their lying-in; and almost in every instance my prediction was verified. (Gordon, 1795, quoted by O. W. Holmes, Medical Essays, Contagiousness of Puerperal Fever. Houghton, Mifflin & Co., 1888, p. 103.)

So much for surgery. Less tangible results can be claimed for clinical medicine, but, as it seems to me, solely because of the infinitely greater complexity of the problem presented, not because the results thus far gained do not apply as directly to the management of cases of medical as of surgical disease. It would be absurd to say that one is not better fitted to manage cases of disease produced by bacteria, after a knowledge of the action of these bacteria has been gained, imperfect as it yet is and must continue for years to be, for what we already know is of great importance, if only it be perfectly applied; and the promise of what we shall know in the near coming years is of greater importance still, for the management of individual cases, for treatment, and for self-protection, as well as the prevention of the spreading of infectious diseases. It needs only to mention the most destructive of these, tuberculosis, to call an illustration to mind. Thirty years ago the infectious nature of this process was not generally acknowledged, and even Villemin's experiments failed to make that knowledge general. Since the discovery and study of the microörganism concerned in its production it has been possible to give advice and to formulate rules for our patients, based upon scientific knowledge, that must surely have tended to prevent the spread of the disease by reason of the careless distribution of the infectious matter coming from the patient. In other words, we have learned the scientific lesson that the infectious material in this disease, when seated in the lungs, is contained in the sputum; knowing that, we know how to control its spread. The same thing is true in regard to many other diseases, and the knowledge thus gained enables us to handle them with greater confidence and precision than heretofore: typhoid fever and cholera, with their infectious material in the intestinal discharges, and pneumonia and diphtheria, with theirs in the expectoration, are common examples. Indeed, it is not necessary to go further in the way of illustration, for the slightest thought given to the matter will call to everyone's mind instances of what is meant. So far as the treatment of specific diseases in individual cases is concerned, it is true that, as yet, but little of wide applicability has been obtained. Diagnosis, in certain most important cases, has been greatly helped, however. It is now possible to give the patients affected with pulmonary tuberculosis a chance for their return to health in that most important period of the disease, the so-called "pre-tubercular stage," a period extending over weeks or months, in which the physical signs may not furnish a basis for a positive diagnosis, but where doubts may be set at rest by the microscope. The bacteriological diagnosis of cholera and diphtheria are extremely important factors in the management of these diseases, and medico-legal questions demanding settlement by bacteriological methods are becoming more and more frequent as the importance of these methods are becoming known to the legal profession; also, the possibility of treating disease by methods resulting from and forced upon bacteriological research is becoming more and more prominent, and certainly these methods and the experiments leading up to them can not possibly be properly understood without some definite knowledge of bacteriology. The results obtained in tetanus, both in the laboratory and in the clinic, in pneumonia, diphtheria, and streptococcus infection, give such promise as to lead every medical man to desire to know something of the work upon which they are based. Even tuberculin, great as the failure to fulfill unjustifiable expectations was, seems to offer later results, in some of its modifications, that warrant hopes for the future and more favorable development in regard to it. At the least, it must be said that in the direction of the study of the bacteria and their products lies the greatest promise for advance in our knowledge of the etiology and management of disease now open to us. Naturally, in a subject of such far-reaching importance and so new to investigation, dealing with processes that are so delicate in nature and complex in completion, mistakes have been made and will be made again; but surely the sum total of results for the last ten years is something

to be proud of and of such value that it can not be neglected in any plan for well-balanced medical instruction.

Turning from clinical medicine to that branch which has to deal with problems of the general health of the people at large, the same intimate connection between bacteriology and many of these problems is then found. The general principles governing the development of the bacteria must be well understood by public health officers in order that they may properly discharge their duties, and persons competent to carry on an effective manipulation of these microörganisms must be at command for the proper investigation of subjects constantly demanding it. The volumes of the reports of the Massachusetts State board of health bear constant witness to this, as do those of other States and countries that have appreciated the importance of the developing facts of scientific investigation. The instances in which work of importance has been carried out in this direction are almost innumerable. That showing that the milk of tuberculous cows may contain the bacilli of the disease, even if the udder be apparently unaffected (done under the auspices of the Massachusetts Society for Promoting Agriculture and supported by parallel investigations in other countries), is one instance; the great work being done upon the filtration of water and sewage, the study of the nitrifying organisms by the German, French, and Massachusetts boards of health is another; and the reports of the national bureau of animal industry furnish many more. All of these results, and many others like them, are of necessity spoken of with more or less elaboration in any instruction that may be given in surgery, medicine, hygiene, physiology, or pathology, they form a part of all such subjects, but in no one of them is there a proper place for the fundamental instruction necessary to a proper comprehension of what the bacteria are, or what their importance in connection with disease may be. This is as true in bacteriology as in regard to anatomy, without a specific knowledge of which no medical curriculum is complete. That bacteriology can not be properly included under any of the present divisions of medical instruction seems also to be almost self-evident; to include it under the head of pathology shuts out at once a consideration of that part of the subject that relates to general hygiene and the broader subjects of the fermentations; while, if it be included under the head of hygiene, the limitations of the subject are again closer than its natural scope demands. Biology, from the standpoint of the general scientist, would of course include bacteriology, but here, instead of being too narrow, the danger would be that the extent of the instruction given would be too broad. For it is always necessary to remember, in laying out a course of instruction for medical students, that the important things for them to know are, first of all, those that can be practically applied in the management of disease in human beings, and that then should follow whatever may tend to make these practical things easier of comprehension. The facts of general biology are of great importance for the sum of human knowledge, but so many of them may be ignored for medical purposes that it would seem to be inappropriate to speak of biology where bacteriology alone is what it is desired to teach. Lastly, and perhaps more important from a practical point of view, the necessity for some sort of systematic training in bacteriology is made manifest almost daily in hospital work. The idea that ready methods of staining are all that are needed to enable the house officer to make bacteriological diagnoses is a very common one, and leads constantly to disastrous failures or mistaken conclusions. Ready methods are meant only for the expert, and can only be properly applied by him; to teach them to the beginner is sure to lead to misinterpretation. Perhaps no better illustration of what is meant can be given than that of tuberculosis. Rapid methods for demonstrating this organism are in constant use, and are taught to beginners everywhere, so commonly, in fact, that no single protest is likely to be of any avail against it; and yet my own experience and that of the gentleman working with me have shown conclusively that

there is no method of staining that may be constantly relied upon except the old one of Koch. Of course it is true that some of the others will demonstrate the bacilli in most cases, and when they do no more can be asked. But when the organism is not shown by these methods one is not justified in saying that it is absent. Now, this is an exceedingly important point for the patient, and yet it is one that the student is almost certain to lose unless he has been brought along by proper gradations to realize the use of what he is doing in attempting to stain the bacilli of tuberculosis. What sort of instruction, too, can that have been that will permit a senior house officer to attempt to get middle cultures in gelatine so hard and dry as to be able to turn the edge of an ordinary scalpel, or to wonder why a similar fresh medium does not remain solid and show expected peculiarities of development when planted in a breeding well? Experience shows universally that these and similar blunders are the constant results unless the student has a foundation of systematic training in the best methods of bacteriological work before being trusted with these shorter methods that should never be employed except after much training, if at all. Therefore, because the subject seems part of so many others, and because in no one of these others does there seem to be a fitting place for systematic instruction in the principles and methods of bacteriology, it has seemed best, in the minds of many experienced instructors, to set aside a special department in the medical course for the special study of this branch; and the example set a few years ago by one or two of the most progressive medical schools of this country is being rapidly followed, until to-day there is a special department of bacteriology, or special instruction in that subject, offered by a large majority of those of the better class. So that the question seems to have been fairly well settled already that, in the minds of those most competent to judge, there is a necessity for specific instruction in bacteriology for the complete education of the modern medical man; and this instruction is offered with more or less completeness.

It has been a matter of some interest to me to see how far this instruction is given in this country, and to that end I have looked over the published announcements of a number of medical schools that happened to be in the hands of the secretary of the Harvard Medical School and that were kindly loaned by him for the purpose. They are all of them announcements for the year just closed or just opening, and contain, therefore, as recent information as can be obtained. They are also, all of them, of schools that require a graded course and three terms of instruction preparatory to the conferring of the medical degree; they represent, therefore, the better class of medical instruction as given in this country. A summary of the results obtained in the study of these announcements shows the following interesting facts: There were 68 schools included in the number examined. Of these, 38 have no special officer of bacteriology, while 30 have an officer of some sort, ranging in rank from the full professor of bacteriology down to the simple assistant instructor in the same. Of these 30 schools that have special officers of instruction there are 19 that have but one, 7 that have two, 2 that have three, 1 that has four, and 1 that has five. When the study of the number of these schools that offer special instruction in bacteriology is completed we find that it sums up 50, leaving but 18 out of the whole number that do not offer or require some special instruction in the subject that we are considering; and closer search shows that of these 18, 8 are irregular or women's schools (all but 2 of this sort that were in the original number). From this it appears that there is a rather remarkable showing; that over 72 per cent (without the 8 spoken of, over 83 per cent) of these schools should be offering special instruction in this branch of medical science, when less than ten years ago it was not thought of as even a possible part of medical education. But further investigation shows even a more important point still; that in this number of schools in which advantages of special

study are offered, 14 of them (a little over 20 per cent of the whole number) make a regular course and examination in bacteriology a part of their course for the medical degree. Another notable thing about this is that out of the 50 colleges offering instruction but 3 of them announce lectures alone; all the remainder speak of more or less elaborate and prolonged training in special bacteriological laboratories. This is as it should be, for no real knowledge of the bacteria, such as the medical man should have, can be given by didactic lectures alone; actual manipulation is the only means by which this branch should be taught. That it should be taught as a separate branch in all well-balanced courses of medical instruction seems to be demonstrated. How it should be taught, that is to say, how much special instruction should be given, and in what part of the course, is the second branch of our inquiry. It will easily appear, from what has already been said, that there are two ideas of the subject to be considered: First, in this branch, as in all others, how much is necessary for the intelligent instruction of the average medical man? This much should be given to all medical students. And second, how much should be taught of the great experimental problems opened up but still unsettled by results obtained in this branch of medical science? Under the first heading falls naturally the study of the facts upon which the principles of sterilization and disinfection are based, as well as the application of the aniline dyes and the special adaptation of the microscope to this work. To these are to be added certain well-established methods of cultivation, and the study of certain of the commoner forms of bacteria, both parasitic and saprophytic, both as observed in the laboratory and in the clinic. In other words, each student should be obliged to know as much of the life, history, and methods of observation of the bacteria as will make it possible for him to understand references to them in other parts of his course, on the one hand, and, on the other, to know the common forms of clinical application of methods of diagnosis. This much it seems necessary that every medical student should know. On the other hand, inasmuch as a medical course may properly have for its object the development of something beyond the average practitioner, advantages should be offered to such individuals as develop a taste for the work and a desire to push further in the study. Such advantages as these can be very well offered in the form of an elective course that the student may or may not take, according as his taste and impulse guide him, but the elective should contain much that is manual and should consist largely of laboratory work carried on by the student himself. In this work should be studied, besides the more minute investigation of the subjects included in the regular course, such questions as the bacteriological diagnosis of cholera and diphtheria; questions that can be determined only by means of culture methods combined with the microscope, not by the microscope alone. Lastly, there should also be offered to those few who have time and ability opportunities for original research along some one of the many paths that this new science has opened up; paths as yet untrodden, but leading with pleasant promise to unknown goals. How this special instruction may be given may be best illustrated by a short account of what is done in this line in the department of bacteriology in the Medical School of Harvard University. There are there offered three grades of instruction, and the effort has been to make these cover, as far as possible, the three grades spoken of above. There is, first, the required instruction, consisting of a course given in the second term of the first year and ending with an examination which every student is obliged to pass before taking the degree of doctor of medicine. This course consists of eighteen hours of lectures and eighteen hours of laboratory work for each student and, so far as the laboratory work is concerned, is designed especially to make the student familiar with certain of the simpler methods of manipulation and staining, such as are in common use and are generally needed being those selected. The lectures cover a theoretical explanation of the processes carried on

by the bacteria, and a preliminary explanation of their importance in the various changes produced by their activity, and are illustrated by the microscope, cultures, and elaborate lantern slides.

The laboratory course covers the following subjects: (1) Method of making cover-glass preparations; use of the aniline dyes; cover glasses made and stained. (2) Explanation of plate cultures and reason for their employment; importance of sterilizing the hands and the difficulties in the way; the hands are washed as thoroughly as may be and then plate cultures are made from them. (3) The plate cultures are examined (colonies are counted); test-tube cultures and cover-glass preparations are made from some of the colonies. (4) The group of suppurative bacteria is taken up; cultures and cover-glass preparations of several of them are made. (5) Diphtheria, illustrating peculiarities of shape; colonies and staining; cultures are shown and cover-glass preparations are made. (6) Cultures and sections are prepared (these organisms being used to show a class differing from the true bacteria). (7) Pneumonia; cultures, cover glasses, and sections (to show the non-unity of a disease until recently supposed to be of a single origin). (8) Gonorrhœa; cover glasses prepared (illustrating important facts of arrangement and employment of aniline dyes). (9) Tuberculosis; cultures, sections, and sputum (illustrating peculiarities of staining).

The principle object sought for in laying out this laboratory work was to bring in as many practical illustrations of important facts in regard to the bacteria as the time at command would allow, and the result seems to have shown the success of this endeavor. The students enjoy the work, and there has not any complaint been heard, except that there was not enough of it. They came to the course after a good drill in the ordinary methods of handling the microscope and the study of normal histology, and before they had come under instruction in general pathology or clinical medicine. The next opportunity that this same set of students will have offered to them will be the elective course that is given in the first term of the fourth year, meaning from the last week in September until the first week in February. This course covers the same ground, and more, and consists of lectures combined with the laboratory work; by that is meant that there will be no special didactic lectures out of the laboratory. At the beginning of the exercise enough time will be taken to thoroughly explain the work laid out for the day, so that the student may understand the principles upon which that work is based, and then each man will complete the practical work set aside for the day. The completion of this course will give the student a very good idea of the essential points in this important branch of investigation and will make him competent to go on with a line of special research, if he desires to do so. This course is open to graduates in medicine, and a similar one is given during the summer of each year. Last, and perhaps not the least important, are the facilities offered for special research. These facilities are in a separate laboratory, consisting of a large room divided into a number of smaller ones that are set aside for those desiring to carry on a long series of investigations. There is a special advantage in this, in that there is no disturbance from beginners, who never work in this laboratory at all, all of the instruction spoken of in the two first courses being carried on in a separate or preparatory laboratory, well removed from this. All of the best and most recent appliances for scientific work are procured as they are needed. There are animal rooms and cages for the isolation of inoculated animals, separate operating, culture, sterilizing, and wash rooms, with a special chemical room for the study of alkaloids of bacterial origin. The features of the instruction as given at the Harvard Medical School are: (1) The use of two large, thoroughly equipped laboratories solely for bacteriological work, one of these laboratories being reserved entirely for advanced students, the other for beginners. (2) The grading of the work in this department, by means of which the student

may easily prepare himself; first, with enough knowledge to utilize the clinical methods learned here; and second, to carry on special investigation if he wishes. (3) The special encouragement constantly given to efforts in the direction of scientific investigation. So far as can be learned from the public announcements, there is but one other school in which equal attention appears to be given to this special branch of medical instruction, by that, of course, meaning instruction to undergraduates, and this is the University of Michigan. In the medical department of this institution there are required courses in bacteriology extending over twelve weeks and every day. Four hours a week are devoted to lectures and recitations in the first half year. Bacteriological analysis of water is especially taught. Advanced courses are offered to graduates who have taken these others, and special courses in the study of the ptomaines and leucomaines are given as well. Experience has taught that the best time for introductory studies in bacteriology is in the earlier part of a medical course, and that more elaborate work should come late in that course or after it is completed, and this is precisely what is done in the two schools in the country that lay most stress upon the matter.

I hope I have made it clear that there certainly appears to be a demand as well as a warrant for special instruction in bacteriology to medical students, aside from what must come to them in most of the larger branches of medical education. The time when the instruction should be given, and its amount, while necessarily modified by circumstances, should be about as indicated in the discussion of what is being done.

DISCUSSION.

Dr. F. G. Novy, of Ann Arbor, Mich. The position of bacteriology in a medical course and the extent of instruction which should be given is a matter of so much importance that I deem it desirable to briefly touch upon the work as carried on in the medical department of the University of Michigan. The year in which bacteriological instruction is to be given deserves careful attention. While in some medical colleges the work in bacteriology is reserved for the senior year, or even for a post-graduate course, in others it is given in the freshman year. We have tried the course in each of the four years of our curriculum, and have found that the most satisfactory results are obtained when it is given in the first year. One great benefit which a student derives, or should derive, from laboratory instruction in bacteriology is the habit of cleanliness, patience, and perseverance. From his work in the laboratory the student learns of the chances of contamination and the dangers of infection. The familiarity with methods of personal disinfection and the sterilization of apparatus and instruments fits him for his subsequent work in medicine and in surgery. The study of bacteriology by lectures and in the laboratory, therefore, properly belongs to the first part of a medical course, before the student enters upon the study of diseases and on his clinical work. The relation which the subject bears to the subsequent work in medicine is the same as that possessed by chemistry, anatomy, and histology, and it should therefore be carried on in conjunction with these subjects. The instruction in bacteriology in this university is twofold. During the first semester of the year didactic lectures, four times a week, are given on the morphological and biological properties of bacteria; on their chemical products, and on their relation to fermentation, putrefaction, and disease. The infectious diseases are considered and so also are the principles of sterilization and disinfection. The course in laboratory work covers a period of three months and is given three times during the college year. The entire afternoons of every week is devoted to the work. Each student therefore spends four hours each day, for three months, in practical work in bacteriology. The preparation of the various culture media, the study

of a large number of saprophytic bacteria and bacteriological examinations of air, water, and soil, precede the work with the pathogenic microörganisms. Every student isolates, cultivates, and studies each microörganism by himself, and in this way acquires the carefulness in manipulation and the confidence in the methods which it is necessary to have before entering upon the study of pathogenic bacteria. I am not in sympathy with the plan of instruction, unfortunately only too often followed, which on the plea of danger removes the study of the pathogenic bacteria to the senior year, or even later. The place to study the bacteria of disease is in connection with and subsequent to the elementary work on methods and on the ordinary bacteria, and if this preliminary work is properly done there need be no fear of infection. The practical value of the laboratory work in bacteriology begins with the study of the pathogenic bacteria, and for that reason this study should be made to follow the preparatory work and should be made as thorough as possible. In the course as given in this university from six to eight weeks are devoted to the study of pathogenic bacteria, fungi, and animal parasites. The students make their own inoculations on animals, perform the post-mortem examinations, and isolate the pathogenic bacteria from the tissues, thus demonstrating to themselves the relation of microörganisms to disease. The detection of bacteria in the fresh tissues and in sections, as well as their isolation and the study of the pure cultures, is given careful attention. In this way are studied all of the well-known pathogenic bacteria, including the anaërobic forms, as those of tetanus, symptomatic anthrax, and malignant edema.

PRELIMINARY MEDICAL EDUCATION IN THE UNITED STATES.

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The fundamental requirements of sound preparation for all kinds of professional education may be drawn from Galen's admirable saying that "the best physician is also a philosopher." The blending of technical perfection with the philosophic mind constitutes the ideal of all professional attainment; and the problem of preliminary medical education is simply how to aid the medical schools to the utmost in their strivings toward this ideal. We shall see that preliminary medical education should minister to both of the ends and that it is desirable to establish the basis of a philosophic mind while laying the foundations for professional education.

Persons still young have had the opportunity of witnessing a remarkable change of opinion concerning preliminary medical education in the United States. It was formerly believed that the only thing to do was to get a good general education, and the more general it was the better. Professional education was regarded as a kind of necessary evil, or at least as something of small value from the educational point of view and, therefore, to be postponed as long as possible. Accordingly, students who desired the best preparation for medical studies were kept as long as possible in the college, giving their attention to miscellaneous, and especially to so-called "disciplinary," studies, most of which were avowedly irrelevant to all professional subjects, and therefore (so the theory ran), especially desirable for those who must afterwards be "cabined, cribbed, confined," in professional studies. But with the advancement of more varied knowledge, the development of men of culture and capacity outside the colleges,[1] and especially with the con-

[1] "It is not by academically trained men, as a rule, that the great physical discoveries have been made. Those who have made these discoveries have broken away, so to speak, from the traditional life of a student and a scholar; have quitted the books and betaken themselves to the study of things." J. G. Fitch, Lectures on Teaching in the University of Cambridge, England, p. 357, 1880.

quests of science, it has dawned afresh upon educators that there is no royal road to learning. It is perceived that common sense, order, insight, exactness, imagination, truthfulness, reverence, and the love of truth, whether old or new—these and other elements of the philosophic mind can be developed in the same person (if at all) in any one of many ways. This change in the educational point of view has gone on until in the present state of opinion the tide is setting powerfully in the direction of definite and relevant preparation for all kinds of professional work as opposed to miscellaneous, indefinite, or irrelevant preparation. Nowhere is this more strikingly evident than in preliminary medical education. Some of the prophets, however, cry out that this will result in a set of possibly deep but inevitably narrow specialists; that if man's general culture be not cared for early by others he will never care for it himself, perhaps never get time to care for it. Culture, on this theory, would seem to be a kind of drug which, if not administered early, will fail to take effect. For myself, I do not believe in this theory. As long ago as 1865, Dr. Jacob Bigelow, one of the ablest physicians of Boston, and one of the most cultivated, advanced, and thoughtful men of his time, in an address upon the "Limits of education" before the newly founded Massachusetts Institute of Technology, dealt with it as follows:

I have dwelt on the importance of a special and well-selected path of study as leading to success in education and not less in subsequent life. Nevertheless the necessity of absolute confinement to this path is to be accepted with great modifications. A youth with vigorous and varied powers will not easily restrict himself to a beaten track, but as his mind grows he will become discursive in his aspirations. He will carry along with him not only the adopted or select pursuit which has enabled him to serve, to impress, or to excel others, but he will also be prompted, both before and after he has grown up, to entertain himself and to extend his relations with those who surround him by devoting his surplus time, which his very success has given him, to the enlargement of his sphere of occupation.

Some persons, no doubt, on any system of education, will become mere specialists, and mere specialists are better than mere dilettanti, for they are usually not only very happy themselves but extremely useful to the rest of mankind. Many dry-as-dusts have arisen on the old system, which in its time has borne much knotty and unmellow fruit. A still more vigorous denial of the charge that early specialization in education necessarily means narrowness or failure we owe to Prof. George H. Palmer, professor of philosophy in Harvard University, in his important papers on "The New Education" (Boston, 1887):

The popular distrust of specializing is sure to grow less as our people become familiar with its effects and see how often narrow and thorough study, undertaken in early life, leads to ultimate breadth. It is a pretty dream that a man may start broad and then concentrate, but nine out of every ten strong men have taken the opposite course. They have begun in some one-sided way and have added other sides as occasion required. Almost in his teens Shakespeare makes a specialty of the theater, Napoleon of military science, Beethoven of music, Hunter of medicine, Hugh Miller of rocks, Faraday of chemistry, Hamilton of political science. The great body of painters, musicians, poets, novelists, theologians, and politicians are early specialists.

But the best of all answers and the keynote of the whole tendency of education to-day is Goethe's:

Willst du in's Unendliche schreiten?
Geh' nur in's Endliche nach allen Seiten.

There may be always two kinds of preparation for professional studies, one germane to the future profession, the other foreign to it, or at least irrelevant. Both kinds, the germane and the irrelevant, are still to be seen. The old-fashioned college still sends men to the medical schools irrelevantly prepared. The elective system, itself the chief monument of the new education, suggests and favors but does not compel relevancy in preparation for professional studies. The group system compels it.

The history of special or relevant preparation for medical studies is the history of heroic attempt of disinterested educators to aid in the improvement of medical education. Twenty-five years ago candidates for medical schools were entirely destitute of relevant preparation. Those who came from the higher institutions of learning were supposed to have well-disciplined minds and much general information; but they were nearly as ignorant as their fellow-students from the farm, the factory, or the workshop of any of the subjects germane to medical studies, such as physics, chemistry, and natural history. Many of them have made excellent physicians, but there is reason to believe that they might have achieved even greater success and in greater numbers if they had been better prepared for the study of medicine. The establishment of sharply defined courses of study preparatory for the professional study of medicine at the Sheffield Scientific School at Yale, the Johns Hopkins University, Cornell University, the Massachusetts Institute of Technology, the Lawrence Scientific School, and other institutions of learning in which an effort has been made to fit men expressly for the medical school, has been an attempt to help on medical education toward the lofty ideal of Galen, and to multiply the number of those physicians who shall be philosophers also. It was because educators saw the raw material which medical schools had to work upon and determined to improve it. They saw or believed that they saw how, by imparting a liberal education of the hand, the eye, and the brain, largely through subjects more or less germane to medical studies, they might send to the medical schools candidates, already bachelors of arts or of science, trained in laboratory ways, informed with respect to nature, including living nature, and especially human nature, with some loss of breadth perhaps, but with an immense gain of depth. They hoped that the medical profession, which was loudly talking of the low standard of medical education, would meet them half way and make some adequate recognition of a difference between men well prepared and men not well prepared on admission. But in this they were at first disappointed. Too often the graduate well prepared had no warmer welcome at the medical school than the graduate not well prepared or even unprepared. One year in some other medical school even of low grade gave an uneducated man precedence over both; and so, except in one or two cases, the attempt has languished chiefly for lack of encouragement on the part of the medical schools. But a change is at hand or has already come. The better medical schools, in a sincere attempt to compel the unprepared candidates, who are generally in a large majority, to remain with them long enough to obtain a sound professional training, within a very few years have doubled the period of required medical education. But in doing this they have sacrificed without mercy the candidates who had taken pains to prepare themselves well, and also those who had obtained collegiate or scientific education before beginning their professional studies with no very definite idea of what they were doing, but with a most praiseworthy wish to get a sound preliminary education. No exception has been made and no provision for these, "the flower of our youth," except admission to the medical school by diploma instead of an easy examination. The result is likely to be, and the danger is, unless some amendment can be made, and that very soon, that many who might otherwise be more liberally prepared, and whom it is most desirable to have so prepared, dismayed at the prospect of an excessive cost of time and of money, will avoid both of these by passing from the secondary school to the professional school. One of the important secondary schools in Boston is offering in its prospectus the logical alternative of these conditions, viz., "Preparation for all universities, scientific, law, and medical schools." It is fair to suppose that the possibility of directly proceeding to any one of these is kept before the boy, and, what is equally important, before his parents. It must require some argument to convince a doubter that he should take two of these (usually) four-year courses instead of one, so long as he observes

that in many medical schools no important difference is recognized between beginners well prepared and beginners ill prepared. It is the difficulties to which this curious state of affairs leads that have moved Prof. Welch, dean of the Johns Hopkins Medical School, to remark that there are, in respect to preliminary medical education, "very serious and important difficulties peculiar to the system of education in this country."[1] Prof. Welch believes that the main trouble is with the colleges "which keep the students two years after the study of medicine should begin." This may be true; but the trouble is not wholly with them. It comes quite as much from the rapid doubling of the period of required medical education from two to four years without due regard to the needs of the most desirable students. But we must turn from the disease to the remedy. That which Prof. Welch proposes, as the contribution of the Johns Hopkins University, has the distinction of compelling the nongraduate to come up to the standard of the graduate candidate, and the further immensely important advantage that the candidate shall not only offer evidence of possessing the philosophic mind, but also a considerable foundation for professional attainment, inasmuch as he must have had a thorough, if elementary, training in the natural sciences of physics, chemistry, and biology, as well as in modern languages. This is not only an interesting concession to the educational Zeitgeist and a great gain for the student who has wisely prepared himself, but also a graceful recognition of the value of the efforts of those universities and scientific or technical schools which have so long sought to help on the higher medical education. The practical difficulty, however, remains and is even aggravated, namely, the element of time and money. The medical education proposed by the Johns Hopkins University, so far as outlined at present, will inevitably be very long and very costly. Educators may well raise the question whether it is not unnecessarily long and too costly, and also whether the Johns Hopkins University, which has already done and still aspires to do so much for medical education, is absolved from educational criticism by the bare statement of its dean, "We fully realize that the number of students who will meet these rigid requirements is not likely to be large." In the John Hopkins scheme the greatest hardship falls upon ordinary college students, "the flower of our youth," who during their blossoming have not seen fit to take, or have had no chance to take, physics, chemistry and biology as required for admission to the Johns Hopkins School. These, with diplomas in their hands, must yet be turned away, for fruit, not "flower," is wanted. But such will not long be the case; and sound educators will rejoice that this has been done, for it will compel the colleges to classify or even group their courses preparatory to medical studies, and will in so far give point and system to their work. If it has now become recognized that the college, the university, and the scientific school may thus powerfully aid the medical school, may we not hope that the medical schools will themselves take one more step and encourage their candidates to come prepared not only in the subjects mentioned for their professional welfare, but also in physiology, general anatomy, and physiological chemistry to the end that one whole year of time and money may be saved for the now overburdened medical student? Of the two years which need to be cut off from the period of complete medical education, including preliminary education, it is only fair that one shall come from the medical school and the other either from the colleges (or similar institutions) or from the secondary schools. There are signs that the latter saving will not long be delayed. The former might easily be accomplished; is, I believe, already accomplished in the Harvard Medical School, the pioneer in these reforms, by simply granting advanced standing to those who can pass off on entrance the first-year subjects. In the prospectus of the Johns Hopkins Medical School there are no strictly professional subjects in the first year; and if this school should hereafter allow those

[1] Address before the Johns Hopkins University, June, 1893.

who are prepared in these to omit that year and to enter the second year of the medical school a great incentive will be offered to universities, colleges, and scientific or technical schools to save that year for their graduates by allowing them to take these subjects during some part of their four-years' course. For these institutions the gain in sharpness of definition, in enthusiasm, in seriousness would be immense, and the moderate sacrifice of educational idols involved would not be irreparable. For the medical schools the practice would even then be merely that which already prevails and works admirably in another group of professional schools, the scientific or technical schools, namely, to allow graduates of colleges and other scientific or technical schools to enter by diploma; to excuse them from all subjects in which their proficiency is satisfactory and allow and require them to take whatever professional studies they are prepared for and have not had. In all essential respects a medical school is a technical school: that is, a school in which a practical profession is taught, as Prof. Huxley long ago observed. Is there any good reason why it should not act accordingly and abandon the idea that any special halo surrounds the subjects pertaining to medical education, making it indispensable that physiology, general anatomy, physiological chemistry, or even pathology, must needs be taught in technically medical schools if any virtue is to be in them? When this state has once been reached the problems of preliminary medical education can be left to settle themselves by a kind of natural selection and survival of the fittest.

THE AIMS AND METHODS OF MEDICAL EDUCATION.

By WILLIAM C. DABNEY, M. D.,

Professor of Practice of Medicine, etc., in the University of Virginia, and formerly President of the State Board of Medical Examiners of Virginia.

The ultimate aim of medical education is to fit those who enter upon the study of medicine to prevent and cure disease and to relieve suffering. For the proper accomplishment of this work several things are necessary. (1) A sufficient development of the faculty of observation and the reasoning faculty to enable the person to judge of cause and effect and to draw proper conclusions from ascertained facts; (2) a knowledge of the work done by others directly or indirectly connected with medical matters; (3) an ability and willingness to work; (4) a just appreciation of the extent and character of the work which they undertake and of the responsibility which they assume.

I propose to consider in this paper the importance of these different subjects—"avenues of training," if I may use such an expression—and shall endeavor to show by what methods the mental training and discipline of a medical student may be best accomplished. Let me say in the beginning, however, that in the consideration of the requirements of those entering upon the study of medicine I have in view the great numbers who yearly enter our lecture rooms with very moderate intellectual capacity, scant literary training, and often the most deplorable ignorance of the gravity of the task and the responsibility on which they are entering. These are the men and women who treat the great masses of our people, and who need, therefore, the best medical education and training which can be given them. I recognize the fact, so encouraging to all who are interested in higher medical education, that among those entering upon the study of medicine there is from year to year a larger and larger number whose minds have been broadened and enlightened by preliminary training, and who are thoroughly alive to their own responsibility and the needs of humanity; but the medical teacher should always keep in view the needs and requirements of the average medical

student, and not of the favored few, who, by reason of natural ability or superior preliminary training, will overcome all obstacles and far outstrip their less favored associates.

I have stated briefly the chief requisites of those entering upon the study and practice of medicine. The next question which presents itself is, What are the best means of attaining these requisites? I shall consider this question under the following headings: (1) The preliminary studies calculated to develop the faculty of observation; (2) the preliminary studies calculated to develop the reasoning faculty; (3) the order in which the various branches of medicine should be studied; (4) the time which should be given to laboratory work and lectures each day; (5) the value and importance of the didactic lectures and of daily recitations; (6) the objects and methods of clinical instruction; (7) the importance of a high standard of graduation in medical colleges, with especial reference to the character of the work done by the graduate in after life.

(1) The Preliminary Studies Calculated to Develop the Faculty of Observation.

No argument would seem to be necessary to show the importance of a habit of careful observation of details in the study and practice of medicine, yet it is surprising to see how many persons well educated in other respects are woefully deficient in this. It would take me beyond the scope of this paper to consider, except in the most cursory manner, the means by which the faculty of observation is to be developed before the study of medicine is entered upon. Yet it is a matter of the utmost importance, especially at the present time, when so many institutions of learning are arranging the studies in their academic courses with reference to the subsequent professional studies of the student. The academic studies which seem to me of most importance for this purpose are geology, zoölogy, and botany, especially the last of the three. All of these branches of study necessitate the most careful observation of details, but botany is of especial value because of its intimate connection with bacteriology. When the study of medicine itself is entered upon chemistry, anatomy, histology, and bacteriology are the studies which necessitate careful observation, and are therefore of the utmost importance, not only on account of their intrinsic value, but as a means of mental training and discipline as well. There are, of course, other subjects which necessitate careful observation, indeed all branches of knowledge do, but those which I have named seem to me the most useful for developing this faculty in the medical student.

(2) The Preliminary Studies Calculated to Develop the Reasoning Faculty.

The academic studies which are valuable for developing the reasoning faculties and which are of especial value to those who propose to enter upon the study of medicine are natural philosophy and logic. I do not mean to exclude mathematics from this list, but I have not named it specifically because it is a subject studied by all to some extent at least, and the value of which for purposes of mental discipline is universally recognized. Nor would I underrate the value of the languages, ancient and modern, not only on account of the wide field which they open up for instruction and entertainment, but because of the broadening influence which they exert upon the mental faculties. I am old-fashioned enough even to believe in the study of Greek, not only for its own sake but for its influence upon the intellectual faculties as well. Still, it seems to me that no other academic studies are as useful to develop the reasoning faculties of the student who proposes to enter upon the study of medicine as those which I first named; natural philosophy

and logic. The medical studies proper which are most useful for this purpose are physiology and pathology viewed in its broader aspect. I shall speak of this more in detail when I come to consider the value of didactic lectures.

(3) The Order in which the Various Branches of Medicine Should be Studied.

There is but little difference of opinion nowadays on this point, and it is almost universally conceded that some knowledge at least of chemistry, anatomy, normal histology, and physiology is absolutely necessary before the student can profitably engage in the study of the so-called practical branches. A few colleges, I believe, still expect the student to begin his medical studies with the daily attendance upon lectures on anatomy, chemistry, physiology, materia medica, obstetrics, practice, surgery, and perhaps a number of special subjects, but the number of these schools is growing rapidly less, and it is almost certain that in a short time all medical schools which are worthy of the name will adopt a graded course and give the student some time for study outside of the lecture room.

(4) The Time which Should Be Given to Lectures and Laboratory Work Each Day.

Not many years ago the students in many if not most medical schools were expected to attend lectures from 8 or 9 A. M. till 5 or 6 P. M., with one hour's intermission for dinner, and then to make their dissections at night. It is hard to conceive how the intellectual faculties of a student could be developed by this process. Mental confusion and physical fatigue would combine to retard rather than aid the development of these faculties. Three hours a day at most, it seems to me, is all the time that should be required of the student so far as listening to didactic lectures is concerned, and scarcely any more time should be given to laboratory instruction if both didactic lectures and laboratory instruction are given the same day. From four to six hours more, the time depending on the physical strength and mental training of the student, might be profitably spent in reading carefully in some good text-books the subjects of the lectures of the day and in comparing what has been seen in the laboratory with the teachings of those who are especially skilled in laboratory work. I do not speak here of clinical instruction: that subject has already been considered by Dr. Shattuck, and I will allude to it briefly a little later on. I need only say just now that it seems to me far better that the undergraduate should see a few cases daily and study those cases well than that he should have his mind crowded with difficult subjects, none of which can be properly digested.

(5) The Value and Importance of the Didactic Lectures and of Daily Recitations.

There is at present a manifest tendency to do away in great part with the old-fashioned didactic lectures, and to substitute for them laboratory and clinical work on the one hand and the reading of judicious text-books on the other. Nor can it be denied that the change has been of immense value to medical education; but I am firmly convinced that on many branches of medicine didactic lectures, if properly given, are of great value as a means of education; that is, as a means of making men think and reason for themselves. For example, in the study of practice of medicine, with all the excellent books on the subject, none of them can or does explain the connection between causes, morbid anatomy, symptoms, etc., as is done in the didactic lecture; nor can an author emphasize in a text-book the points which may be of especial moment without making the book of inordinate length. I would offer an earnest plea, then, for the retention of the didactic lecture

as a means of instruction, of teaching men to think, not to the exclusion of other methods, but as a valuable adjunct thereto. Then there is another means of instruction which I believe to be of inestimable value, but which, unfortunately, can not be thoroughly applied in large medical schools; I mean daily recitations on the subject of the previous lecture. These recitations are a means of instruction both to teacher and to pupil; the teacher learns from them what points he has failed to make clear, and the pupil is taught not only what he has failed to catch before, but something far more important than that; the necessity for careful and thorough study and preparation. And much as I value the didactic lecture as a means of instruction, or rather of education, if I were compelled in my own teaching to abandon it or the daily recitation I would unhesitatingly discard the didactic lecture, for in the course of the recitations nearly all the explanation needed could be given.

(6) The Objects and Methods of Clinical Instruction.

There are two objects to be attained by clinical instruction. The first, which is of great importance to the student, is the method of conducting the examination of a patient; and the second is to learn the symptoms and signs of diseased conditions. For the attainment of these objects it is essential that the student should not only see examinations made by others, but that he should see and hear and feel for himself. It is equally important, too, that the student should have clear views of what he does see and hear, and for this reason it seems to me far better that the undergraduate at least should see but few cases a day, and should be required to study them thoroughly, both at the bedside and in the text-books. Another point seems to me of the greatest importance in connection with clinical instruction, namely, that the student should have been thoroughly drilled in the principles of medicine before he begins to study cases, so that he can understand the significance of the various symptoms and signs and their connection with the morbid changes in the body. For example, how can a student understand the passive hyperæmia and dropsy of advanced cardiac disease who knows nothing of the anatomy and physiology of the heart and vessels, and how can he apply the proper treatment unless he has studied the pathology of the process and the action of drugs?

(7) The Importance of a High Standard of Graduation in Medical Schools with Especial Reference to the Character of the Work Done by the Graduate in After Life.

If I may judge from my own observation and the conversations I have had with a number of physicians who are interested in medical education, the importance of a high standard of graduation on the subsequent work of the student is not appreciated as I am satisfied it should be. It goes without saying that a man with very scant knowledge of medicine is not a suitable person to intrust with the health and lives of his fellow-creatures; but it is usually thought and often said that the defects and deficiencies of early training will be corrected by the experience of subsequent practice. Doubtless this is true in a measure; but there is another side of the subject which I believe to be equally true and of vast importance in medical education, namely, that the graduates of a school having a high standard of graduation will have a higher aim and do better work all through life than those who have had equal advantages in all other respects, but who have received their medical training in a school which considers a high standard of graduation unnecessary. Of course there are many exceptions to this rule; but, as I stated at the beginning of this paper, I am considering the educational needs of the great mass of medical students and not of the comparatively few of exceptional ability. My

attention was first called to this matter in 1885, when the graduates of many different medical schools came before me, as a member of the State board of medical examiners of Virginia, to stand their "State examination." It was a matter of profound astonishment to me and to my colleagues on that board to see the superficial character of the answers given to many of the questions by men of good sense, fair general education, and graduates of schools having admirable facilities for instruction and whose faculties would compare favorably with any in the world. I well remember the surprise depicted on the faces of some of the young men who were rejected, and the statement made by some of them that they had never been taught that "all those details were necessary in medicine." The superficial character of the answers sometimes required may be judged of also by the questions asked. I remember, for instance, in an examination on anatomy lasting three or four hours one of the six questions given the student to answer in writing was, "Describe the alimentary canal and its appendages." Now, Mr. President, how can a young man of average capacity be expected to learn thoroughness when the questions given him on examination are of such a character that only the most superficial answers can be given? How can earnest, painstaking, careful, and thorough work be expected of him in after life, when his training has been such as to encourage the reverse, and that training has been received from men of acknowledged ability and experience? I need not call attention to the necessity for a high standard of graduation as an evidence of the student's medical knowledge (or ignorance) when he comes up for examination; yet when graduates of respectable schools gravely state, as was done to our Virginia board, that "the post-partum artery should be tied to control post-partum hæmorrhage;" that in case the carotid artery is cut the physician should "keep the patient quiet and watch him close;" that "60 grains of atropine is the dose by the mouth, but 20 grains will do hypodermically"—in view, I say, of these answers, a little more care, it seems to me, is often desirable in testing the amount of medical knowledge possessed by the candidate for graduation. In conclusion, then, I would plead most earnestly for a higher standard of graduation, not only because it necessitates more knowledge of medical matters when the student graduates, but because it gives him a keener sense of the gravity of the duties which he has assumed and of the responsibilities which rest upon him.

LA HIGIENE CEREBRAL Y EL EJERCICIO DE LA INTELIGENCIA.

Por el Dr. LUIS E. RUIZ,

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La vida con salud es el resultado de la armónica y regular actividad de todas las funciones, lo cual lógicamente advierte, que el ejercicio de las facultades es indispensable condición para permanecer sanos; pero este ejercicio ha de satisfacer dos condiciones higiénicas fundamentales: ser desempeñado por todas las funciones y proporcional en cada una. Solo de esta manera la integridad del ser humano es completa, pues á su bondad estática se une su corrección dinámica y de hecho en la vida se realiza el hermoso apotegma: mens sana in corpore sano.

La observación y la experiencia de consuno nos atestiguan con la irrefutable elocuencia de los hechos y su científica coordinación, que si malo es el quietismo de las funciones, porque viene la torpeza de las facultades, no es menos nocivo el exagerado ejercicio de ellas porque acarrea la atrofia. Luego el primero de los bienes, la salud, exige en nombre de la diosa Higia el moderado funcionamiento

fisio-psíquico. Pero si de esta consideración, puramente médica, que nos hace aconsejar saludable y total ejercicio, pasamos á otro orden de ideas ya del dominio pedagógico, ya del económico y social, muy fácil es convencerse de que la actividad de nuestras facultades es el único eficaz medio que poseemos para satisfacer nuestras necesidades, puesto que estas solo se cumplimentan con actos, que no son otro cosa sino variadas intervenciones de nuestras facultades.

Así pues, si las necesidades económicas de nuestra situación social, nos obligan á trabajar, si las exigencias de la salud han menester regularizado movimiento, y si el deseo del bienestar individual exige el ejercicio como condición indispensable de perfeccionamiento, tenemos que convenir en que la actividad de nuestras funciones todas, es condición precisa y conveniente para nuestra vida completa. Pero no basta ver con toda claridad, á la luz de la higiene y la pedagogia, que el ejercicio es factor para la salud y requisito de perfeccionamiento, sino que es indispensable precisar el como de este ejercicio. Por otra parte, estas consideraciones no van á referirse á todas las funciones, cuyo conjunto constituye la vida, sino especialmente á la más humana de nuestro ser, á una de las más importantes y más complexas que posee el hombre, á la actividad del cerebro, al ejercicio de la inteligencia. Esta función psíquica, verdadera antorcha de la especie humana, tiene dos modos fundamentales de actividad: adquirir conocimientos y elaborarlos. Por esta circunstancia las facultades especulativas, más que ninguna otra función, necesita la correcta actividad de todas las otras. A la inteligencia, más que á otra actividad, se aplica el axioma pedagógico expresado así: "El correcto ejercicio de las facultades superiores exige la integridad completa de las inferiores." Si la respiración es defectuosa, la inteligencia se entorpece; si la circulación no se hace bien, los actos intelectuales no se ejecutan correctamente; y el concurso de la alimentación es de tal manera valioso para los fenómenos mentales, que gráficamente un inteligente professor ha dicho: "Dime lo que comes y te diré lo que piensas." Y á semejanza de esto podríamos ir señalando el enlace y la dependencia de la inteligencia con las demás funciones; pero baste saber que si la inteligencia acumula conocimientos, estos en su mayoría vienen precisamente por los sentidos, y tan cierto es esto que el incomparable Aristóteles, exagerando un poco la verdad, dijo: "Nada hay en la inteligencia que no haya estado antes en los sentidos."

Por último, los movimientos ya generales, ya parciales, influyen de tal manera sobre las labores intelectuales, que en multitud de casos la inactividad muscular acarrea la pereza mental y por el contrario, el exagerado ejercicio de los músculos trae aparejada señalada torpeza del intelecto. La inteligencia, como las demás funciones de relación, tiene períodos de actividad y períodos de reposo, durante los cuales, más que ninguna otra, por la naturaleza de su funcionamiento ha menester descanso completo, pues solo con este requisito conserva su salud, aumenta su vigor y es capaz de agigantar su perfeccionamiento. El sueño es el reposo para nuestro espíritu y por lo mismo siempre que vayamos á disfrutarlo, debemos procurar todas las comodidades, ya de silencio y ausencia de luz, ya requisitos higiénicos del lecho y ya que antes de entregarnos á él no experimentemos por nuestras labores, musculares principalmente, grande fatiga. De esta manera, y teniendo cuidado de que la duración del sueño sea en todos los casos suficiente para el reposo y descanso cerebral, es indudable que habremos asegurado la base higiénica para el mejor ejercicio de la inteligencia. Mas este ejercicio tiene su más valioso campo en la escuela, puesto que la evolución mental que vamos á determinar, mediante la enseñanza, para que sea del todo propicia al éxito de nuestra vida completa, es absolutamente necesario que se ajuste tanto á los preceptos higiénicos, que han de conservar incolume su salud, como á las reglas pedagógicas que aspiran á perfeccionar facultades y á inculcar conocimientos. Si la educación puede y debe empezar desde la cuna, la instrucción jamás ha de

iniciarse organizada antes de los siete años, pues quien á esta fecha se adelante obliga al cerebro á un trabajo prematuro, comprometiendo su salud, y hace infructuosos los esfuerzos intelectuales, tanto más estériles, cuanto más laboriosos y abstractos.

La actividad inagotable del niño y su insaciable curiosidad están demostrando que sus órganos necesitan ejercicio, sus facultades empleo; pero su volubilidad característica, la superficialidad de que todos dan pruebas, señalan al mismo tiempo el camino que se debe seguir para enseñarlos. Es decir, presentarles asuntos sintéticos, motivos que susciten la aplicacion del mayor número de facultades, en cada caso, y los estimulen por el placer, dando rienda suelta á su actividad. Pero ya los conocimientos organizados por la abstracción, esto es, ya la instrucción debe dejarse para cuando el niño tiene major estructura cerebral, después de los siete años. Y no debe olvidarse, ya sea que se trate de ejercicios educativos, es decir, de la gimnasia de las facultades, mediante objetos ó fenómenos presentes, ó bien después de la edad señalada como punto de partida para la instrucción de retener nociones abstractas cada vez más generales, no se debe perder de vista, repito, que las lecciones no deben ser muy largas y que el principio del cansancio mental debe ser el indicante para terminar el trabajo. En las labores escolares es indespensable pasar de un conocimiento á otro; pues bien, este mismo hecho constituye un descanso, siempre que tanto uno como otro trabajo sean limitados y suficientemente diversos entre sí, pues es claro que entonces las facultades que toman parte principal en uno, no la tomarán en el otro. La memoria, facultad preciosísima, y que es en alto grado valiosa cuando nos limitamos á que solo desempeñe en la actividad mental su magnífico papel, puede llegar á ser nociva para el regular funcionamiento de la inteligencia, si queremos que, á toda costa, todo se aprenda de memoria, entiéndase ó no; pero semejante cosa debe desecharse por el notorio perjuicio que acarrea al saludable ejercicio de las otras facultades, que casi deja en la inacción.

Mas dándole forma preceptiva á los conceptos anteriores, diremos: (1) Deben cuidarse higiénicamente las funciones de nutrición y las facultades de relación. (2) Se debe dormir en el mayor reposo, más en la infancia que en la edad adulta. (3) No debe principiar la enseñanza instructiva antes de los siete años. (4) Al principio de la enseñanza deben predominar los ejercicios educativos, elementales, pero variados; y siempre en el estudio debe irse de lo concreto á lo abstracto y especializando lentamente. (5) Debe irse en todo aprendizaje de lo particular á lo general, de lo conocido á lo desconocido y de lo independiente á lo dependiente. (6) La duración del estudio, en cada caso, no debe ir más allá del instante en que se inicie cansancio mental. (7) Durante el trabajo intelectual se debe variar el asunto del estudio y deben ir seguidos los más disímbolos. (8) Solo debe encargarse á la memoria lo que haya sido comprendido por la inteligencia. Tal es en breve síntesis lo principal que atañe á la higiene del cerebro y á la pedagogía de la inteligencia.

METHODS OF MEDICAL EDUCATION.

By VICTOR C. VAUGHAN, Ph. D., M. D.,

Dean of the Department of Medicine and Surgery in Michigan University.

I will suppose that we require of our students on admission to the medical school not less than is required of those who enter the scientific department of our best universities. Certainly our requirements for admission should not be less than this. Our students have had fair training in English, at least one year in Latin (though two would be better), a reading knowledge of German or French or both, have been well drilled in mathematics through arithmetic, elementary

algebra, and plane geometry, are fairly well posted in general and national history, and have received fair instruction in the elements of physics, botany, zoölogy, and physiology. I state that I will assume that our medical students have had the above-mentioned training. Our best high schools do this work, and do it fairly well. I wish to state here, parenthetically, that an experience of more than fifteen years has convinced me that the average graduate of our best high schools does his medical work quite as satisfactorily and intelligently as the average graduate of a classical course in college; while the man who has taken a scientific course in one of our best universities has an advantage over both of the others. For one, I shall be opposed to requiring of our matriculates the possession of a bachelor of arts or a bachelor of laws degree until the courses leading to these degrees in our colleges have undergone some radical changes. With such requirements and with a medical course covering four years of nine months each devoted to instruction, what shall we teach and how shall we teach? The first part of this question is easily answered. There are certain sciences from which medicine draws all its resources. Without these sciences there would be no medicine, as we teach and practice it. These sciences are physics, chemistry, botany, anatomy, physiological chemistry, histology, bacteriology, and hygiene. Our student has had, before admission, a fair drill in physics, and it will only be necessary to develop certain branches of this very broad subject. One semester of lectures, accompanied by demonstrations and strengthened by text-book recitations on heat, light, sound, and electricity, is at present quite necessary, and would remain so were all our students bachelors of art. The student will get additional information on many of these points in other courses. Heat and light must be discussed in the course in hygiene. Refraction will be dwelt upon in the demonstration course in ophthalmology. Electricity will be investigated in the laboratory of electro-therapeutics. It would be well if general and analytical chemistry could be required for admission to the medical school, but unfortunately the instruction given in this science in many of our colleges is so inadequate, and in some instances so erroneous, that the student who has had no instruction has an advantage over the one who has for years memorized formulas and written equations. Even in our scientific schools the study of chemistry has been narrowed down to methods of analysis. Lectures and text-book work are essential, but they should never become the chief reliance in the study of chemistry. The student should be supplied with adequate laboratory facilities, then given a chemical substance, and be requested to ascertain experimentally all he can concerning its solubilities, incompatibilities, and decompositions. This experimental study should be supplemented by properly directed reading. Analytical tables and schedules should not be placed too early in the hands of a student. They make of him a mere manipulator of test-tube reactions, which he produces but fails to understand.

In nearly all of our medical schools anatomy is taught, not as a broad and important science, but simply for the service which it may render the physician and surgeon in their work. The embryological development of the various anatomical structures is not considered. Time is spent in memorizing the names of the smallest muscles, blood vessels, and nerves, and the great wealth of knowledge which would be opened up to the student by even a short study of comparative embryology and anatomy is wholly lost. The effect of this method of teaching anatomy tells upon those who give instruction in this branch as well as upon those who listen. The professorship of anatomy is made a stepping-stone to that of surgery, and one can easily see why the number of scientific anatomists, those who conduct valuable researches in this branch, are so few in this country. The study of anatomy too frequently means simply a study of osteology and myology, with a glance at the blood vessels and nerves. The idea that one can understand

the complicated morphology of the central nervous system of man with the super ficial and careless attention given to it by the average medical student is absurd Visceral anatomy is another part of this broad subject to which insufficient atten tion is given. On the other hand, if the student has had good training in genera biology and has dissected different types of animal life, beginning with some o the lowest and least complicated in structure, anatomy becomes a most deepl interesting subject. He now sees the plan of development. Please understan that I do not suppose that any extensive course in general biology or comparativ anatomy could be or should be included in a four-years medical course, but thi work should be embraced in the preliminary training. Those of us who may hav influence in shaping the lines of study offered in the courses preparatory to medi cine by our scientific schools and universities should bear this in mind, and i these schools fail to provide proper instruction in this and other branches, w must lengthen our terms of medical study to six or seven years and give suc instruction.

The teaching of bacteriology simply by lectures or recitations without practica laboratory work is a farce. Some time ago I received a letter from a professor o bacteriology in one of the prominent medical schools in one of our large cities asking me to send him some cultures of pathogenic bacteria. I replied that if h would send me agar tubes I would inoculate the same and return them to him He then wrote me asking what agar is and how such tubes should be prepared That certain bacteria bear a specific causal relation to certain diseases has bee demonstrated beyond all peradventure, and yet hundreds of medical students ar given their degrees and thus licensed to treat these diseases without being taugh the methods of detecting and isolating the germs. The lecturer tells his student that the Löffler bacillus is the cause of diphtheria and that in many instances th recognition of this bacillus is the only method by which a correct diagnosis ca be reached, and yet the student is not instructed in the technique necessary to mak this diagnosis, and he goes forth practically ignorant and helpless on this poin This is not just to the student. Practical, thorough laboratory instruction i bacteriology must not only be offered to, but must be required of, every medica student. Is it any wonder that one of our leading medical journals has latel complained that the whole field of preventive medicine is likely to be divorce from medicine? The trouble is that medical education has not kept abreast of th recent discoveries in science. The medical man properly instructed should be th best equipped sanitarian, and yet I have more than once heard an intelligent lay man trying to convince an ignorant doctor that the so-called germ theory is n longer a mere theory, but is founded upon demonstrated facts. If medicine is t hold its position among the learned professions our medical schools must teac bacteriology, not only by lectures, but by weeks of thorough drill of each studen in the bacteriological laboratory. What is true of bacteriology is also true of th broader subject of hygiene, of which the former is but a part. In talking with prominent physician in London a few years ago I expressed a desire to meet on of the most eminent sanitarians of that city. "Oh," said my friend, "he is not doctor, he is only a sanitary crank." Will the profession thus throw aside it most worthy possessions? Is not the man who prevents disease worthy to b ranked with him who treats typhoid fever or amputates a crushed limb? Are w to say that the Jenners, Pasteurs, Pettenkofers, and Kochs do not belong to us Yet there are many architects and engineers who know more about the principle of ventilation, water purification, and sewage disposal than the average docto does. It is for us who are engaged in the teaching of medicine to determin whether or not the profession of medicine shall possess the rich fields of preventiv medicine. Shall we turn this work over to others? This certainly must not b done. Why should not the sanitarian who studies the chemistry and bacteriolog

of drinking water and the adulterations and putrefactive changes in food be a specialist in medicine as well as the ophthalmologist or the laryngologist? Certainly the medical man who has had broad training is better fitted to do work in preventive medicine than he who knows nothing of disease. The answer to this question will depend upon the facilities which our medical schools offer for instruction in these branches. I hope to see the time when the possession of a degree in medicine will indicate that the possessor has had a broad, scientific training. It is universally admitted that anatomy can not be taught without practical work in the dissecting room, but instruction in physiology is generally given exclusively by lectures, class-room demonstrations, and text-books. Nevertheless it is certainly true that the medical practitioner needs to recall his physiological knowledge quite as frequently as he does his anatomical learning. Indeed, functional disturbances constitute probably four-fifths of the cases which come under treatment. It is quite as important for the physician to know something of the innervation of the heart as it is for him to understand the arrangement of the valves. Laboratory instruction in physiology is desirable, and in physiological chemistry it is absolutely essential. Of course histology and the microscopical study of diseased tissue can be taught only in properly equipped laboratories, and gross pathology in the dead room. Laboratory methods are now carried into clinical teaching by a few of our best medical schools. This, in my opinion, is one of the most important advances which has been made in recent years in the methods of medical instruction. From two to four hours per day for from four to six weeks are employed by the junior student in the surgical laboratory, where he makes amputations, ligates blood vessels, and resects the intestines in living animals, giving all the attention to narcosis, asepsis, and dressing which would be bestowed upon similar operations in man. The class in methods of medical diagnosis must now, in addition to the drill in auscultation and percussion, make chemical and bacteriological examinations of urine, blood, vomited matter, and sputa, the hospital containing a room supplied with the facilities necessary for this work. Demonstrations in obstetrics, ophthalmology, and laryngology are given on manikins. Methods of detecting and correcting errors of refraction are taught to each student. The ophthalmoscope, laryngoscope, and other instrumental aids to diagnosis are employed by the student under the direction of a competent instructor. The student now gets all of these demonstrative courses before or simultaneously with his clinical instruction in the amphitheater, at the bedside, or in the outdoor dispensary. The methods of medical education might be grouped in the following manner: (1) Lectures; (2) recitations from text-books; (3) laboratory instruction; (4) amphitheater clinics; (5) bedside teaching. All of these methods must be employed to some extent. Lectures upon many subjects can not be wholly replaced by text-book instruction. A subject to which new and important contributions are being constantly made can not be fairly presented exclusively by a text-book, however accurate such a book may have been when it was written. It certainly is better to use a book a year behind the times than to listen to a lecturer twenty years behind the times, as some of us probably did during our medical course. Laboratory methods, as I have already stated, are growing in favor, and their application will find a yet wider range. Spectacular clinical teaching, in which the operator or the lecturer is the center of interest, is a theory of the past. Ward and bedside teaching, with all the laboratory and instrumental aids to diagnosis, afford the greatest instruction to the student. Certainly medicine grows constantly more scientific and this growth will continue until our best medical schools will offer better facilities for broad scientific culture than can be found elsewhere.

THE MEDICAL HISTORY OF CHRISTOPHER COLUMBUS, AND THE PART TAKEN BY THE MEDICAL PROFESSION IN THE DISCOVERY OF AMERICA.[1]

By A. M. FERNANDEZ DE YBARRA, M. D., of New York.

Amicus Plato, sed magis amica veritas.—ARISTOTLE.

One of the most important events in the history of humanity, and perhaps second only to the birth of Christ in beneficial results, is, without any species of doubt, the discovery of America by the Spaniards under the leadership of Christopher Columbus. Willing and unwilling visitors certainly did come from the Old World to the New a number of times before that date. In the fifth century of the Christian era a few Buddhist missionary priests came, either directly from China to a country which they called Fusang, and known to us now as Mexico, or they first and most probably, settled in Japan and afterwards crossed from there to the Pacific coast of America; the voyages of the Northmen in the tenth and eleventh centuries, the traditional narratives of which tell us of the deeds of the daring sailor, Eric the Red, and the discovery of Helluland, Markland, and Vinland by his famous son, Lief Ericsson. The story of the Venetian brothers, Nicolo and Antonio Zeno, the first wrecked in 1390 upon one of the Faroe Islands, his subsequent visit to Greenland and return, and the second embarking on an unsuccessful voyage of discovery in the Atlantic Ocean, about the year 1400, to verify some fishermen's reports of the existence of land a thousand miles or more to the west from the Faroe Islands. The old and often-repeated rumors concerning the fancied Island of St. Brandan, which several Portuguese and Spanish captains imagined they had beheld beyond Madeira. The seemingly truthful statement in regard to the Spanish pilot, Alonzo Sanchez de Huelva, who, sailing in 1484 (which should be 1474), "one year more or less," from the Canaries to Madeira, had been tempest tossed by violent easterly winds upon an unknown island (the Island of Hispaniola or San Domingo), where he landed, took an altitude, and wrote an account of all he saw and all that had occurred on the voyage. He succeeded in returning, arrived at Terceira (one of the Azores) sick and worn out, and soon after died, leaving Columbus, who had hospitably received him in his house and nursed him, heir to his papers.

All these, and more, pre-Columbian voyages, legendary reports, and fanciful descriptions of America are completely divested of true historical importance, and did not contribute a mite to our geographical knowledge or to the betterment of mankind. To speak of them as implying, in any sense whatsoever, that they constitute a discovery of America is perfectly absurd. To expatiate about them with the mental reservation of robbing Columbus of his well-earned title of discoverer of the New World is the height of folly. In 1492 the American continent was to a certain degree as unknown to the rest of the world as the nebulous inhabitants of the planet Mars are to us to-day.

On the present four hundredth anniversary of that paramount event in history, almost all classes and conditions of men have endeavored to bring forth their representatives who, in some way or another, had anything to do with it. Mariners are still singing the wonderful skill and intrepidity of their seafaring companions of the fifteenth and sixteenth centuries. The military have spoken of their famous captains, and with minute details referred to their heroic feats and glorious conquests, not always wise or even right. The clergy have told us of the first American bishops, large numbers of pious and lion-hearted missionaries, and the numberless martyrs sacrificed in our luxuriant forests. Politicians have pointed out the

[1] This paper was received too late for insertion in the proper section.

many examples of good, indifferent, bad, and very bad rulers, together with chieftains and leaders totally destitute of diplomatic tact. Lawyers have shown who were at that time eminent legislators, and put on record the notable judicial contests arising in consequence of the discovery of America. Physicians only have remained silent in this universal revival, when we, as a class, contributed very largely to the realization of the constant dream of a great genius, thought then by almost everyone but a distinguished Italian physician and a modest Spanish village doctor to be merely a madman.

If modern anthropological science can justly boast of having made clear the intimate relations existing between the shape, volume, and minute structure of the internal organs of man and his outward manifestations, both physical and psychical, it is evident that in speaking of such a profoundly important historical figure as Christopher Columbus, an humble attempt to examine his personal appearance, temperament, physical ailments, and the cause of his untimely death may greatly help to a more accurate appreciation of his mental characteristics and moral nature.

First, as to the date of his birth. This is a *vexata questio* which it would be out of my power in the limits of this short paper to discuss. Washington Irving, relying upon the evidence of Andrés Bernáldez, a historiographer and intimate friend of Columbus, states it to be about 1435 or 1436. Don Fernando, the admiral's second son and his most faithful biographer, relates that in a letter written by his father to the King and Queen of Spain, dated 1501, he declares that he had then been forty years at sea, and in another letter that he was 14 years old when he first went to sea; so that allowing a year either way for probable inattention to circumstantial details, we get the date of his birth, fixed by his own hand, at about 1447. If we take into consideration that he did not go to sea during his seven years of patient waiting in Spain—from 1485, when for the second time he entered that country from Portugal, to 1492, when he set sail westward on the Sea of Darkness—we must then acknowledge that in referring in 1501 to his being forty years at sea, he did not probably reckon the time spent in surmounting the difficulties encountered at the court of Ferdinand and Isabella. This would bring us to 1440 as the date of his birth; but if we make a calm and philosophical analysis of the expression, "being forty years at sea," from a sailor who had the year before arrived, a prisoner, in fetters, poor, sickly, and dejected, from his third voyage across an unknown ocean, and bearing in mind his former unequivocal statement that he had "followed the sea for twenty-three years without being on shore any space of time worth accounting," in which period he had been to and fro upon the Mediterranean, the Grecian Archipelago, France, Flanders, the coast of Guinea, the Canary Islands, Madeira, Porto Santo, the Azores, Cape Verde Islands, England, Ireland, Iceland, and sailed a hundred leagues beyond this "Ultima Thule" of Ptolemy, we will be forced to admit that that phrase only means a sailor of forty years' experience, the same as any old professor, architect, lawyer, or physician might express himself in like circumstances, regardless of the few years spent in traveling, sickness, or some temporary occupation. The place of his birth was the city of Genoa.

From the accounts of his personal appearance given by his son Fernando, Las Casas, Andrés Bernáldez, Pietro Martire d'Anghiera, the Portuguese historian João de Barros, Agostino Giustiniani, Antonio Gallo, and others who knew him well, I gather that Columbus was a man of commanding presence, tall and well built, with fair, ruddy complexion somewhat freckled, oval face with rather prominent cheek bones, broad and high forehead, medium-size mouth, aquiline nose, grayish-blue eyes, very light reddish hair, and beard prematurely turned gray. He was of a genial disposition, courteous and graceful, his conversation agreeable and interesting to such a point that strangers were quickly attracted and felt at ease. An

indefinable air of dignified command surrounded him, and the magnetism of h noble soul was perceptible in the tender glance of his glowing eyes when his re gious enthusiasm was kindled by the divine spark of genius that abided in hi Of a great nervous susceptibility, his mind was highly imaginative and poetic Naturally religious, he was temperate in eating and drinking and puritanical his habits.

My search for particulars regarding the life of Columbus prior to his arrival Portugal was far from satisfactory. From the period of his first going to se which was about 1460, until the year some biographers say his vessel was burne near the Portuguese coast not far from the city of Lisbon, nowhere in history ha I met with a distinct mention of his name. We have positive evidence, howeve that in 1472 he was in the city of Savona, Italy, from the fact of his signatu being appended as witness to the will of one Nicolo Monleone, under date March 20 of that year. It appears very probable that in 1469 he took part, und the command of a French vice-admiral of the name of Caseneuve, in a successf sea fight to capture several Dutch ships returning from the herring fishery in t Baltic. We find him afterward in a terrible naval engagement between Lisb and Cape St. Vincent, trying to get possession of four richly laden Venetian ga leys on their return from Flanders, the desperate struggle lasting from mornin till evening. The hand grenades and other burning missiles used in the batt caused at last a general conflagration among the vessels, which having been lash together with iron grapplings, could not be separated, and the crews were co pelled to leap into the water to escape the fire. Columbus's son, Fernando, go on to say that "his father, who was a good swimmer, finding himself at the d tance of 2 leagues from land, seized an oar, and by its aid succeeded in reachi the shore." It was close at hand to Lisbon, where he went and there made h abode. This happened in the year 1470 or 1471, and in 1473 he married the Port guese lady, Philippa Moniz de Perestrelo, and went to live with her at Por Santo, a small island on the Atlantic Ocean, 25 miles northeast of Madeira. The his son Diego was born in 1474.

The subject of the medical history of Columbus is a barren one, so barren inde that it has never before been touched upon. I asked the present Duke of Veragu and such living sterling biographers of the illustrious Genoese navigator Mr. Henry Harrisse, Mr. José M. Asensio y Toledo, Profs. John Fiske and C. F Adams, Mr. Justin Winsor, and Mr. Cesareo Fernandez Duro, and they a answered me that they did not know of anybody who had investigated the medic aspect of the life of Columbus. I consulted the librarians of the Smithsonian Ins tute at Washington, Lenox and Astor libraries of New York, and the Publ Library of the city of Boston; I searched carefully all the old standard historic authorities, but little did I find, and here it is embodied. I must, however, acknow edge my indebtedness to a recent monograph, of Dr. Calatraveno, of Madri Spain, for many things I say in this paper about the part taken by the medic profession in the discovery of America. Nearly a year of constant inquiry a exploration in this unproductive field has resulted in what I venture to call n contribution to this first Columbian Pan-American assemblage of scientific me

The piratical character of the seafaring life of Columbus's time, and the peculi construction of the vessels, necessarily exposed its followers to unceasing har ships, privations, and many unavoidable dangers to health. The severity of th early manner of living in a man of such well-marked sanguine temperament that of the immortal sailor, must have very insidiously tended to undermine h naturally strong constitution, after "being at sea twenty-three years, witho remaining on shore any space of time worth accounting," and render him liab at the age of 46 years to the ailments and sicknesses which he subsequent

suffered during his four voyages of discovery to America, to which must be added the grief, disappointment, mental anxiety, and moral depression he endured, all together combining in the production of the chronic disease that put an end to his imperishable career at a comparatively premature period of life. Regarding hereditary predisposition to disease, I may safely say he had none. His father died at an extreme old age (in 1496 or 1498) and his mother a few years before. He was the eldest of five children, four boys and a girl, and not one of the others showed hereditary taint. His parents belonged to the healthy, sound, hearty, and frugal types of the Ligurian peasantry.

On Friday, August 3, 1492, Columbus sailed westward from the little seaport of Palos de Moguer, Spain, to plow the sea of darkness in quest of a new world. On Friday, October 12, of the same year, he discovered America, and also on Friday, March 15, 1493, he dropped anchor, back from his mission, at the same little harbor of Palos. He spent two hundred and twenty-five days in this first round trip to the Western Hemisphere, in which time I have found no record whatever of his having suffered any sickness, except casual references to "sore eyes." This slight and transitory ocular affection, which he often experienced afterwards, I consider to have been probably due to blepharitis or styes or to granular ophthalmia, brought on by straining the eyes in search of land in a diaphanous atmosphere where the rays of light are most intense. Perhaps the admiral's leaning toward albinoism also contributed to it. His excellent eyesight at night seems to lend weight to this opinion of mine.

He undoubtedly suffered great anxiety, tribulation, and mental anguish when the crews began to murmur and finally became openly impatient and mutinous at not finding land; but this prejudicial moral effect on his health must have been entirely extinguished by the joy, satisfaction, and pride of having succeeded in his stupendous enterprise. The two shabby tricks of Martin Alonzo Pinzon, captain of the caravel *Pinta*—by far the best sailer of the three—when on the 20th of November, sailing along the coast of beautiful Cuba, he treacherously deserted his chief, and on the 12th of February he surreptitiously abandoned him again to bring the news of the discovery home first, must have also caused Columbus no little pain and dejection.

He put to sea again on his second voyage of discovery, from Cadiz, September 25, 1493, this time with a fleet of three galleons or carracks and fourteen caravels, carrying 1,500 people on board, instead of the 120 who accompanied him in his former unparalleled hazardous cruise.

This large number of men, among whom were many aristocratic young fellows, daring, supercilious, irascible, and obstinate hidalgos, left without occupation at the end of the war with the Moors, were placed under the medical care of Dr. Diego Alvarez Chanca, a distinguished practitioner of great reputation in the city of Seville, who was also physician in ordinary to the King and Queen of Spain, and had attended their firstborn, Princess Isabella (who afterwards became Queen of Portugal), during her serious illness the year before. Speaking of him in a memorial addressed to Ferdinand and Isabella, dated January 30, 1494, Columbus wrote:

You will inform their Highnesses of the continual labor that Dr. Chanca has undergone, from the prodigious number of sick and the scarcity of provisions; and that, in spite of all this, he exhibits the greatest zeal and benevolence in everything that relates to his profession. As their Highnesses have intrusted me with the charge of fixing the salary that is to be paid to him while out here (although it is certain that he neither receives nor can receive anything from any one, and does not receive anything from his position equal to what he did receive and could still get if he were in Spain, where he lived peaceably and at ease, in a very different style from what he does here), I have, nevertheless, not ventured to place to the credit of his account more than 50,000 maravedis (about $725) per annum, as the sum which he is to receive for yearly labor during the time of his stay in this country.

The letter or report of this learned and magnanimous man to the Chapter o Seville, from which I quote two passages further on, is the first scientific mono graph written about America, and worthy of careful perusal.

On the 27th of November the fleet arrived in the harbor of La Navidad, in th island of San Domingo, and found the little fortress completely destroyed, an each and every one of the 38 men left there on the first voyage had been mas sacred by the native Indians. Columbus caused to be built a neat little town, t which the name of Isabella was given, and remained in this island until April 24 1494, when he put to sea again and discovered Jamaica, May 3, and visited Cub for the third time; returning from there, he passed by all the southern coast o Jamaica and Hispaniola and discovered the little islands of Beata, Saona, an Mona.

The day after leaving this last island, in the passage between San Domingo an Porto Rico, September 25, 1494, worn out with the toil and hardships of a five months cruise among people who, though very kind and generous, could no afford him the relief and comfort he so much needed, and in which time his inces sant watching, nervous excitement, and high hopes of finding large quantities o gold and spices had sustained him wonderfully, the inevitable reaction at las overtook him, and his whole system suddenly collapsed. "He lay in a stupo knowing little, remembering nothing, his eyes dim and vitality oözing, until th little fleet sorrowfully, but gladly, entered the harbor of Isabella." Columbu himself acknowledges that for thirty-three days he had slept next to nothing, whe he began to feel very tired and fell into a lethargic state which almost deprive him of his life. He remained sick very nearly five months, under the care of Dr Chanca.

In the early part of April of that year he had been seized with intermitten fever at Isabella, where the same principles of heat, humidity, porosity of th soil, and presence of decaying vegetable matter, which gave an extraordinar fecundity to the uncultivated fields, worked havoc among the Spaniards. Man of them are also said to have suffered at La Vega under the torments of a diseas called "the scourge" (syphilis?), the origin of which, whether American o European or Asiatic, has been a subject of great dispute for over three centuries Dr. Chanca, in his letter to the Chapter of Seville, expresses himself on the situa tion thus: "One-third of our people have fallen sick within the last four or fiv days, which I think has principally arisen from the toil and privations of th journey, and another cause has been the variableness of the climate." In anothe place he says: "The admiral had at one time determined to leave the search fo the mines until he had first dispatched the ships, which were to return to Spai on account of the great sickness which had prevailed among the men." Does h refer here to venereal diseases? I incline to the affirmative, but in the sense o gonorrhœal and not syphilitic diseases. Concerning his first statement, that on third of the colonists had fallen sick in four or five days, I firmly believe it wa due to the bad quality of the provisions brought from Spain, and to malarial infec tion, not very well understood in those days. The miraculous *pulvis febrifugi orbis Americani* was not yet known to Europeans. The existence and wonderfu virtue of "quinquina," which later on saved the life of Charles II of Englan Louis XIV of France, and Frederick the Great, were then only known to the nativ inhabitants of undiscovered Peru.

What was that dangerous disease from which Columbus did not entirely recove for nearly five months? Was it a disease of the nervous system? The only affec tions of that kind most likely to have developed are acute softening of the brai or idiopathic meningitis. But acute softening occurs always in very old person is apt to be preceded by mental confusion, a feeling of numbness, and some sligh impairment of motion; and in idiopathic meningitis there are from the beginnin

an intense headache, vertigo, nausea, and vomiting. These two diseases also run their courses generally in a short time, the usual termination in acute meningitis being death; cerebral softening always leaves behind permanent disorder of the mental, sensory, or motor functions.

Could it have been scurvy? Decidedly no, because, although scorbutus was in those days a very familiar disease among soldiers and sailors, arising from a deficiency of fresh meat or vegetable diet, and sometimes to be found also in badly ventilated, dark, and damp prisons, owing to the want of proper assimilation of food, neither insomnia, stupor, nor delirium form a part of the onset of this disease. Besides, scurvy is so slow and gradual in its development that the patients do not know when it begins.

In the absence of a clinical history of the case, let us scrutinize a little more the simple historical account of the disease. In going from Mona to Porto Rico, Columbus's fatigue and weakness and want of proper food "cast him into a dangerous disease between a pestilential fever and lethargy, which deprived him of his sense and memory." This is his own way of expressing his malady. It certainly was, then, one of the following three low-type fevers—typhus, typhoid, or relapsing.

We must not lose sight of the fact that he had just got over a protracted attack of paludal poisoning, which consequently left him in an anæmic and debilitated condition at the time of embarking in this five-months cruise, thus offering an inviting soil for the favorable incubation of a specific, blood-disorganizing fever such as the above-named ones.

Not knowing the exact bodily temperature, nor the characteristics of its daily variations (and for the best of reasons—the clinical thermometer had not yet been invented), nothing whatever in regard to the peculiarities of the pulse, the actual condition of the skin, the tongue, the bowels, the presence or absence of eruption, epistaxis, lung symptoms, nausea, or vomiting, the anomalies of the urinary excretion, etc., we can not make a good differential diagnosis between those three low specific fevers. As a rule, we find in all of them the same symptoms of general malaise, weakness, drowsiness, at the beginning of the disease; but my opinion is, however, that it was typhus, because of the prolonged convalescence, which must have been due to some pulmonary complication, partial paralysis, scurvy, dysentery, suppurative inflammation of parotid, submaxillary, or inguinal glands, or more probably of the joints. There is another important circumstance which leads me to make the diagnosis of ship fever, and that is that Columbus, as a general rule, very seldom went ashore, but remained on board while waiting at the different harbors, coves, anchorages, and roadsteads, thus necessarily exposing himself more to the infection than the average of his companions, whose nervous systems could not have been in such an unstrung and depressed state as his.

When Columbus recovered consciousness at Isabella he found his dear brother Bartholomew, whom he had not seen for six years, seated by his bedside and tenderly nursing him. This happened on the 8th or 9th of October, which shows that the stupor lasted during the first two weeks of the disease—another diagnostic symptom in favor of typhus.

Early in March, 1496, the immortal navigator sailed for Spain; but he did not arrive there until June 11, having exhausted all his provisions, and the famine was such that the crews came near eating up some of the thirty or more Indian captives whom they were taking to Spain. The haggard and starving party dropped anchor in the same harbor of Cadiz from which many of them had joyously set sail with Columbus two years, eight months, and sixteen days previously.

Columbus started on his third voyage of discovery with a fleet of six ships, carrying about 200 men besides the sailors, from the little seaport of San Lucar de Barrameda, on May 30, 1498. On June 21, at the island of Ferro (the most west-

erly of the Canaries), the admiral divided his fleet, sending three ships directly to Hispaniola, while with the other three he steered southwest. Prosecuting his voyage toward the Cape Verde Islands, in the last days of June, and "as he advanced within the tropics, the change of climate and the close and sultry weather brought on a severe attack of the gout, followed by a violent fever," says Washington Irving. On the 31st of July he discovered the island of Trinidad, and caught a glimpse of terra firma at the delta of the Orinoco River: coming out from it through the passage which he named Dragon's Mouth (Boca del Dragon), during the second week of August, "he suffered a great deal from gout and ophthalmia," says Navarrete.

These two are the first distinct and positive historical references to Columbus suffering from gout. As for the the transitory ophthalmia, I have already stated my opinion about it, only adding that it is a frequent complication of rheumatism, but not of gout. Now I shall endeavor to prove that Christopher Columbus was never afflicted with gout, which is contrary to the firm belief of all accepted standard non-professional authorities.

Gout is more decidedly hereditary than rheumatism, and occurs in those who live high or drink large quantities of malt liquor, or is seen in persons whose systems have been impregnated with lead. The greatest maritime genius of the fifteenth century was of too humble birth to have inherited the gouty diathesis, and too frugal in his habits to have acquired a malady the result of overindulgence in the pleasures of the table, especially when cruising with very scanty provisions; surely there could not have been much lead in his system. Gout is characterized by the occurrence of paroxysms of severe pain in a small joint—the great toe usually. Gout in the foot is called podagra; gout in the hand, chiragra; and gout in the knee gonagra. But Columbus suffered pain in several joints, of the upper as well as the lower extremities, his movement was slow, rigid, and jerking, so that it was accomplished with difficulty, and his disorder, therefore, could not very well be placed under any of these three Latin divisions of gout.

There are yet two very important diagnostic factors against the theory of gout, viz., the season of the year in which exists the greatest tendency to the occurrence of the seizures (winter), these two first attacks taking place in the middle of the summer and, moreover, that we meet in the course of the distemper with no cardiac complication, at least no valvular affection, as so constantly happens in rheumatism, and which sequel was the ultimate result of the disease that launched Columbus into eternity; and, furthermore, in complete possession of all his mental faculties, which does not occur in gout where the morbid changes induced in the kidneys give rise to cerebral symptons at the time of death.

The admiral arrived at Isabella on the 30th of August and was immediately put in irons and thrown into prison by Bobadilla, who had come from Spain a week before. While confined in prison and deprived of intercourse with anyone, loaded with fetters and chains in the fort of the little town, he was sick for several days, probably with intermittent fever or rheumatic pains, improperly called gout. He was put on board a vessel and sent to Spain early in October, 1500, arriving at Cadiz on a December day, and as he passed, his stately and venerable figure burdened with shackles and chains, through the streets of that city he awakened a great popular outburst of sympathy for him and indignation at his persecutors, which reproof immediately reëchoed in the wealthy cities of Seville and Granada.

Fortunately the passage had been calm and fair and of but moderate duration, rendered also less disagreeable by the kind treatment of Alonzo de Villejo, to whom he was given in custody.

While on board the ship he had written a long and eloquent letter, full of pathos, to Doña Juana de la Torre, the nurse (*ama*) of Prince Juan, a lady high in favor with Queen Isabella, to whom her brother Antonio, a fellow-voyager of Colum-

bus, straightway carried the epistle on landing. In studying the ideas and wording of this remarkable letter, I find that his reason was just beginning to lose equipoise under the strain of the great humiliation he was then enduring and the disordered condition in which his unexpected, unwarranted, and unworthy arrest had thrown all his private affairs. This clouded state of his intellect suffered a more aggravated relapse on two or three other occasions, when in moments of despair and heartrending anguish his religious enthusiasm completely overpowered his understanding, and of which I will speak later on.

During the seventeen months elapsing between his arrival from the third voyage and his departure again on the fourth not a word, that I know of, is said in history about Columbus being afflicted with gout, which is a strong argument against the theory of his suffering from that malady. When much better fed, in company of cavaliers and rich men, he should have had more paroxysms of that "eminently respectable disease," as Sydenham used to call it, than when living as a sailor on strange seas, short of the most necessary provisions.

The equipment of the fleet on the fourth and last voyage consisted of four small caravels, with crews numbering, all told, 150 men. Columbus's brother Bartholomew, and his younger son, Fernando, then a boy of 14, accompanied him. They sailed from Cadiz on the 11th of May, 1502, and on the 7th of November, 1504, after a tempestuous voyage and narrow escape from shipwreck, he landed back at San Lucar de Barrameda, so sick and thoroughly worn out that he could not personally go to court to give an account of his new discoveries, but had to send in his place his youthful son, Fernando.

While sailing along the coast of Honduras, in the middle of August, 1502, there was an incessant tempest, with heavy rains and such thundering and lightning that "it seemed as if the end of the world was at hand." The vessels had been so violently tossed about that their seams opened, and the provisions were damaged by the rain and by the leakage. During a great part of this time Columbus "suffered extremely from the gout, aggravated by his watchfulness and anxiety." His illness did not prevent him, however, from attending to his duties; he had a small cabin constructed on the stern of his vessel, from which, even when lying down on his bed, he could keep a lookout and direct the course of the ships. Columbus himself says that many times he was so ill that he thought his end approaching.

The little fleet at last succeeded in passing the Cape Gracias á Dios, on September 14, after struggling with the wind and the waves and the currents for about forty days. When on the coast of Veragua (Republic of Costa Rica), in the middle of October, many days of constant mental disturbance and nights of sleepless anxiety preyed upon a constitution undermined by a slow blood poison, by grief and disappointment, by hardships, by unhygienic surroundings, and by want of proper treatment, finally producing an illusory vision, deemed by Columbus in his religious conceit of private revelation to be really God-sent and supernatural. In a letter to the sovereigns of Spain he gives a very solemn account of this hallucination, in which he heard in the course of a vivid dream a piteous voice reminding him of Scriptural passages to comfort him and encourage him to trust in the Almighty. Such psychical perturbation can easily be explained if we take into consideration Columbus' highly imaginative cerebration, his exalted religious conceptions, his daily devotional exercises, and his deeprooted belief that he was the chosen one from among men to carry the light of the true faith into far distant, unenlightened, and pagan lands. This favorable field, when well plowed by a chronic and painful disease and harrowed by the iron teeth of grief, could without difficulty produce a momentary phonomania. Like the firm trust of all impassioned religious or political reformers, his sublime reliance in his lofty predestination certainly served him to overcome the multitude of obstacles he found in his path. And here we find the proof once more of the undiscernible and undefinable boundary between insanity and genius. While visiting Jamaica in the latter

part of June, 1503, in which island he was obliged to spend a year. Columbus sufered another attack of the so-called gout, and malarial fever of long duration, on the shores of the harbor of Santa Gloria, known to-day as St. Anne's Bay, which rendered him a cripple.

During all this fourth voyage his mental and physical condition was very much weakened, though hope, to be sure, had not altogether departed from his ardent and sanguine nature; but it was a hope that had experienced many reverses, and its pinions were sorely clipped. His voyages of discovery always involved hardships enough to wear out the strongest human frame, having to navigate among unforeseen dangers, without chart or pilot or previous knowledge of the countries, their inhabitants or language; to keep a constant and anxious watch at all hours, in all kinds of weather, subject to the caprices of the wind and without proper food. Age was already rapidly making itself felt when Columbus undertook this his last and most disastrous cruise (55 years old), the ultimate ten years of which were filled with care, physical ailments, and troubles of many sorts. For several weeks before he landed back at San Lucar de Barrameda his tiny ship was thrown hither and thither in mid-ocean by violent winds and hill-like waves, combined with tropical showers. All that time Columbus was suffering the most excruciating pains from his old malady, until his crazy and shattered little bark anchored in the harbor, with her haggard, emaciated, crippled, and almost blind master aboard. From San Lucar he had himself conveyed to Seville, where he hoped to enjoy the much-needed rest of mind and body and to recruit his health; but fortune continued to frown upon him, for he ascertained on arriving at that city that all his private affairs were in a state of confusion and entanglement. Since he had been sent to Spain from San Domingo, shackled like the vilest of culprits, when his house and effects had been seized and confiscated by order of Bobadilla, his rents and dues had been unlawfully retained in the possession of Governor Ovando, the successor of Bobadilla in command of the island. He was therefore in actual penury. He remained at Seville during the rest of that winter and part of the following spring, a victim of his chronic and painful illness.

At the beginning of May, 1505, feeling a little better, he went with his brother Bartholomew to court, then sojourning at Segovia, to personally plead for his rights. While there "he was once more confined to his bed by a tormenting attack of the gout, aggravated by the sorrows and disappointments which preyed upon his heart." From this couch of anguish he addressed one more pathetic appeal to the justice of the King, but all in vain! He sought consolation in devoutly reading the prophecies of the Holy Scriptures and the writings of the fathers of the church, and wrote a religious book and a final long letter, full of poetic mysticism, to that selfish and ungrateful King Ferdinand, the noble and magnanimous Queen Isabella having expired the year before. In making a hurried psychological study of these two opuscules, I find that for the third time the intellect of Columbus was clouded with delusion. The extravagances of his overwrought imagination must not, however, be entirely judged as they appear at the present day. They were in perfect sympathy with the quintessence of those times, when the spirit of the Crusaders was still rampant, when the conquest and fanatical expatriation of the Moslem had just been accomplished, and the Inquisition permeated, enslaved, and terrorized the whole Spanish kingdom.

So poor and helpless at last he found himself, after uselessly following the court from place to place, that he accepted the modest home offered him by kind-hearted and charitable Gil Garcia, a sailor, at Valladolid, Magdalen street (now called Colón), house No. 7. There, propped up in his lowly bed, suffering just as much from the cardiac complications of chronic rheumatism as from mental anguish and dejection and want of proper medical attendance, looking a great

deal older than he really was, but with loftiness of heart, the religious enthusiasm of an old prophet, and Christ-like forgiveness for all his persecutors, under those long, curling white hairs of his, and the gray robe of the order of St. Francis, of whom he had been a great devotee, in which he begged to be clothed and buried, he was uttering words which, to anybody unacquainted with his life, would have seemed very strange indeed. For he was speaking to his two sons and his confessor, Fray Gaspar de la Misericordia, of little else but of another world—not the world of the unknown and unknowable, nor the house not made with hands, eternal in the heavens, to which he was soon to go, but of a new world on this planet of ours, where he had been, of which he was the first to give a faithful account, and to bring from it men of an unheard-of race, and most wonderful specimens of the animal and vegetable kingdoms; a world which should be forever associated with his name, and which will be without any doubt for all coming ages an inexhaustible field for commerce, for industry, for agriculture, for benevolence, philanthropy, and liberty—a true material salvation of the whole human race.

He took his departure from this life on Ascension day, May 20, 1506, a servant satisfied with his work and honorably dismissed from the visible terraqueous globe, which he had very much enlarged, to go to the invisible and everlasting hereafter, whither all of us are marching on, pronouncing with great unction these sublime Latin words: "*In manus tuas, Domine, commendo spiritum meum.*"

What was the cause of Columbus's death, and what part did the medical profession take in the discovery of America?

I have just remarked that he died from the cardiac complications of chronic rheumatism, thus contradicting all the standard historical authorities who assert he was a victim of gout. My humble opinion is that the chronic form of polyarticular rheumatism was not developed slowly, but succeeded to an acute attack, and that this first invasion of the disease occurred on the last days of June, 1498, after Columbus left the Cape Verde Islands, on his third voyage. "The atmosphere was loaded with clouds and vapors; neither sun nor stars were to be seen; a sultry, depressing temperature prevailed," says Washington Irving. A little farther along in his narrative the same high historical authority adds that on July 13 the ships "had entered a region where the whole sea was like a mirror, and the vessels remained almost motionless, with flapping sails; the crews panting under the heat of a vertical sun, unmitigated by any refreshing breeze." The sailors lost all strength and spirits, and there was in the atmosphere, owing to drizzling showers, that combination of heat and moisture so well adapted for a genuine attack of acute rheumatism, and entirely unfavorable for the development of a paroxysm of gout. But the presence of the rheumatic poison was clearly evident in the accompanying "violent fever." Gout is not ushered in by high fever, and during the hours of severe suffering the skin usually remains dry, a general sense of relief being experienced just as soon as a profuse perspiration sets in. A warm climate exerts for that reason a beneficial effect on the occurrence of the seizures of gout. As for the peculiarity of the first attack making its appearance at night, between the hours of 12 midnight and 5 a. m., I can not say anything, because the exact time at which it occurred is nowhere recorded.

Those writers who have minutely described the last few months of the life of Christopher Columbus state that when he was confined in bed his body was extraordinarily swollen from the chest downwards. Here we have the cardiac dropsy met with as the final and fatal result of an old inflammation of the endocardium, brought about almost invariably by an attack of acute rheumatism. The shrinking and induration of the valve curtains of the heart and their tendons, as a sequel of endocarditis, and the hypertrophy and dilatation of the cardiac walls to which these pathologic changes give rise, owe their chief importance to the purely mechanical disturbance of the blood circulation thereby induced, the

action of the heart becoming more and more feeble every day until death at last closes the scene.

The cardiac complications of rheumatism (endocarditis, pericarditis, myocarditis) are by far the most frequent, being present in more than 50 per cent of all cases, and constitute the commonest cause of death in this disease. Bouillaud was the first to recognize the frequency of such accidents, and his great discovery that "their occurrence is the rule rather than the exception in rheumatic fever," has stood the test of all subsequent observers, and remains to-day one of the best established facts in clinical medicine.

Having finished saying what I had to say about the medical history of the immortal discoverer of this New World of ours, I will end by putting upon record the names of those belonging to our noble profession who directly contributed to the realization of such a momentous event in history. The clear intuitions of Avicenna, "the prince of physicians," as he was called; the advice and encouragement given to Columbus by the Florentine physician and distinguished cosmographer, Paul Toscanelli; the modest village doctor, Garcia Fernandez, who, as an improvised expert in mental diseases, won for the perambulating genius the respect and sympathy of the worthy prior of the monastery of La Rabida; the very important fact that, although it is proved beyond doubt that no priest accompanied Columbus on his first voyage, there were two representatives of our profession among his followers—Maestro Alonzo and Maestro Juan—two ship surgeons or *fisicos;* and last, but not least, the learned author of the very first scientific report on America, Dr. Diego Alvarez Chanca, who came over with Columbus on the second voyage, and saved his life during a protracted and dangerous attack of typhus fever. All these facts, scattered in many old books and pamphlets, worm-eaten in dusty archives, are here collected and presented as *pièces justificatives* of the noteworthy part taken by the medical profession in the discovery of the Western Continent.

Almost all those who have written the life and voyages of the immortal Genoese navigator—and their name is legion—speak of the probable sources of his information about the existence of a western route to the East Indies. But none of them, that I am aware of, refer to the writing of Avicenna as a possible fountain of suggestion. This eminently successful physician and most wonderfully learned man was born at the village of Afshend, in the province of Bokhara, Turkestan, Central Asia, in 980 A. D., and died in 1037. Besides his resplendent medical knowledge, he was a profound philosopher, a skillful rhetorician, an excellent geometer, well versed in astronomy and astrology, a shrewd theologian, an accomplished naturalist, and a very fine musician. During the last fourteen years of his life he wrote a considerable number of works on widely different subjects, among which his treatise entitled "De Complexionibus," section 1, chapter 1, where he cites the opinion of Aristotle expressed in his work, "De Causis Proprietatum Elementorum," is an able speculation on the existence of the antipodes.

Paolo del Pozzo Toscanelli was born at Florence in 1397, studied medicine in his native city and became one of the most famous astronomers and cosmographers of his time. On account of his great reputation in nautical science he was constantly consulted by bold navigators from different countries, who unhesitatingly followed his advice and the course marked down for them in the charts Toscanelli himself drew. He was thoroughly acquainted with the scientific and geographical literature of the Greek and Latin classics; became one of the keepers of the celebrated Florentine Library at the age of 30 years, and erected, about 1468, the famous gnomon on the uppermost part of the dome of the cathedral at Florence. He died in that city on the 15th of May, 1482. To this distinguished member of our profession Columbus applied, beseeching his opinion and advice in regard to his contemplated stupendous enterprise, as had also done a few days

before, on the same subject, the powerful King of Portugal. Like the truly scientific and generous man that he was, not only did he immediately answer the two letters of the then obscure sailor, confirming him in his views of the figure of the earth and the practicability of a voyage westward to India, but also sent him a chart drawn by his own hands, in which was marked and explained the course Columbus should follow to reach there in safety. This very chart was the one used by the admiral on his first voyage of discovery. He showed it to Martin Alonzo Pinzon, captain of the caravel *Pinta*, while sailing on the *mare incognitum, tenebrosum*, and both frequently sat on deck discoursing upon it. The historian Las Casas, a contemporary and friend of Columbus, says he saw it and had it in his possession. But it has been irretrievably lost.

The ancient convent of the Franciscan friars dedicated to Santa Maria de la Rábida—where Columbus halted, accompanied by his young son Diego, hungry, thirsty, dressed in tatters, full of dust, and tired from having tramped many miles—is situated at about half a league from the village of Palos de Moguer, in Andalusia, Spain. The humble physician of this little maritime town was Dr. Garcia Fernández, who enjoyed the friendship and high regard of the respected prior of the monastery, Juan Perez de Marchena. This patriotic friar detained Columbus there as his guest, and, diffident of his own judgment as to the sanity of the distinguished-looking foreigner, sent for his scientific friend, the village doctor, to converse with him and to inquire into his mental state. Dr. Fernandez was equally struck with the intelligent appearance and entertaining conversation of Columbus. He discussed with him several geographical and astronomical topics, and became convinced that he by no means was talking to a madman but to a genius. His clear discernment at once detected the possibility of the adventure Columbus was pursuing, and won for him, with his favorable report to the prior, the good will and invaluable aid of that influential religious man. What the result would have been if that unassuming and kind village doctor had given an unfavorable opinion nobody can tell.

Among the few brave men who dared accompany Columbus on his first voyage of discovery to America were two representatives of our philanthropic profession. Maestro Alonzo was the name of one, and Maestro Juan that of the other. The first seems to have been the better known of the two, and came over in the caravel *Santa Maria*, commanded by Columbus, while the second was more of a friend of Martin Alonzo Pinzon, and embarked in his vessel, *Pinta*. Maestro Juan remained at the little fort of Navidad when Columbus returned to Spain, being one of the thirty-eight men massacred by the native Indians of San Domingo, thus paying with his life for his professional devotion. The small band of foolhardy Spanish colonizers were under his medical care.

I have already referred to Dr. Diego Alvarez Chanca, who came with Columbus on his second voyage, and saved his life and that of many hidalgos at the point of death in the Island of Hispaniola or San Domingo. The account given by this distinguished man of science to the municipal council of his native city is undoubtedly an unpretentious evidence of the wide range of his scientific knowledge, and constitutes the first sketch of the flora, the fauna, the ethnology, and climatology of our dear American Continent. He also wrote, on his return to Spain, a work entitled "Comentum Novum in Parabolis Divi Arnaldi de Villanova," published at Seville in 1514.

In conclusion, we, as a class, have sufficient reason to feel proud of the active part taken by members of the medical profession in the discovery of this beautiful land of ours, where the "divine right of kings" is no longer possible, and where the great Chicago World's Columbian Fair has given imperishable existence to the memory of its discoverer.

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